MAY 19, 1958

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R RESEARCH and D DEVELOPMENT news edition

Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT

DESIGN ROADBLOCKS?

see page 17

TRENDS in appearance design . . .

HAND TOOLS

see page 34

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NEWS ITEM No. 5

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In this issue you will find an unusual editorial—in both content and illustration. Based on visits to a number of West Coast engineers, the editor suggests some very important and practical engineering concepts. The illustrations, however, are of space vehicles, showing some of the radical thinking that is influencing current design.

We will welcome your comments, both on the editorial and on the illustrations, plus your own thoughts on . . .

THE SHAPE OF THINGS TO COME

coming next week . . . the DESIGN edition for May 26

FEATURING:

- **Equations predict assembly misfit.**
  Wider tolerances will save money and work quite well—if the odds are right.

- **Geneva wheel design.**
  Diagrams and formulas for intermittent motions.

- **Coriolis acceleration.**
  The mystery is reduced to simple equations, and mechanical examples show how it works.

- **Pressure switches indicate completed movement.**
  Use them like limit switches, to check location. Advantages and limitations.

- **Sandwich panel adhesives.**
  14 most widely specified adhesives described and compared.

- **Pneumatic valve with memory.**
  It holds the position last called for. Useful in automatic sequence applications.

- **Vacuum steel grows up.**
  Already proven for high-strength forgings in large sizes, method shows promise in other fields.

Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT

R and D Research and Development news edition

May 19, 1958 Vol. 29, No. 20

FEATURED:

CRUTCHES WON'T HELP CROSS A DESIGN ROADBLOCK. Space ships set a new standard of "practical" design 17

AIRCRAFT FIRMS GIRD FOR SPACE TRAVEL. Atlas powered space station by 1963 21

POINTS OF VIEW. Should congressional committees hire staff engineers to assist in research and development evaluation? 32

TRENDS IN APPEARANCE DESIGN. Development of a line of powered hand tools as an integrated family 34

DEPARTMENTS

SIDELIGHTS 2

HORIZONS 17

SIGNIFICANT PARTS 38

NEW LITERATURE 46

PUBLISHER'S POSTSCRIPT 48

FYI PERSONAL 49

WHY DON'T THEY R & D? 50

FIELDS OF INTEREST:

MATERIALS:

Vaporizing germ killer for product protection 5
Corrosion control—new ideas from AEC research 5
Aluminum magnet wire for 500 F 12

PROCESSES:

Octane ratings will go up, but more slowly 5
New process reduces wear by a factor of eight 8
More ductile metal parts from powder 12

ELECTRICAL:

Self-powered flashbulbs with built-in battery 5
Control equipment demand is world-wide 8

DESIGN:

Automatic locking for auto accelerator 8
Cheaper atoms for product use 10
Space ship structure weight must be reduced 10
Missile ground support equipment set for standardization 7

TEST:

Operation Pop-Up: dummy Polaris gets test 25
Computer market aims at engineers 28

GOVERNMENT:

Better tax write-off sentiment growing 7
Electronic and engine makers: future primes? 7
Brussels Fair still setting up 23
A reversal: Europeans say US education best 26

Product Engineering .....SIDELIGHTS

Research and Development news edition

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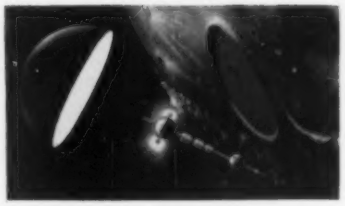
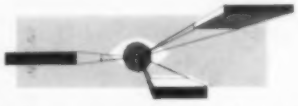


● **Space ships,** on our cover and illustrating this week's editorial (p. 17), have begun to replace the atom as a symbol of science. Such symbols are powerful influences and one commentator suggested infusing nursery rhymes and stories with them in order to make our children more science-conscious. A staff member offers:

Pocket-ta-pocket, the dog in the rocket,
The satellite circled the moon;
The scientist checked the Doppler effect
While the dish was tracking the spoon.

● **Definitions of engineering terminology** have an irresistable appeal to our squirrel instincts. We collect them much the same as others collect bits of string—and with equal uselessness. Here are a few recent contributions from Stanley Orr of U.S. Steel:

Astrogate—Doorway to the stars.
Boron—Feeble-minded dullard.
Mass-charge ratio—Installment-buying statistics.
Phantom circuit—Ghost-to-ghost telephone hookup.
Thor—Mad cause it won't work.



● **Fear of congressional committee action** has industry completely buffaloed. For this week's Points of View (p. 32) we asked both government and industry representatives for opinions on the need for engineers to aid investigating committees. Men in government were reasonably willing to talk. But industry was scared. Out of seven requests, not one company had the courage to be quoted. They simply "didn't want to get involved." What has happened to free speech around here?

● **Monorail design and improvement** described in these pages last month (*PE*—Apr. 7, '58, p. 19) seem to promise real advances in urban transportation. New York City decided to share in this modernization trend by retiring the last of the all-wooden, 1904-model subway trains. They will be replaced with "new" 1906-model half-wooden cars.

ABP MAY 19, 1958 **Product Engineering** *A McGRAW-HILL PUBLICATION* Vol. 29, No. 20 ABC

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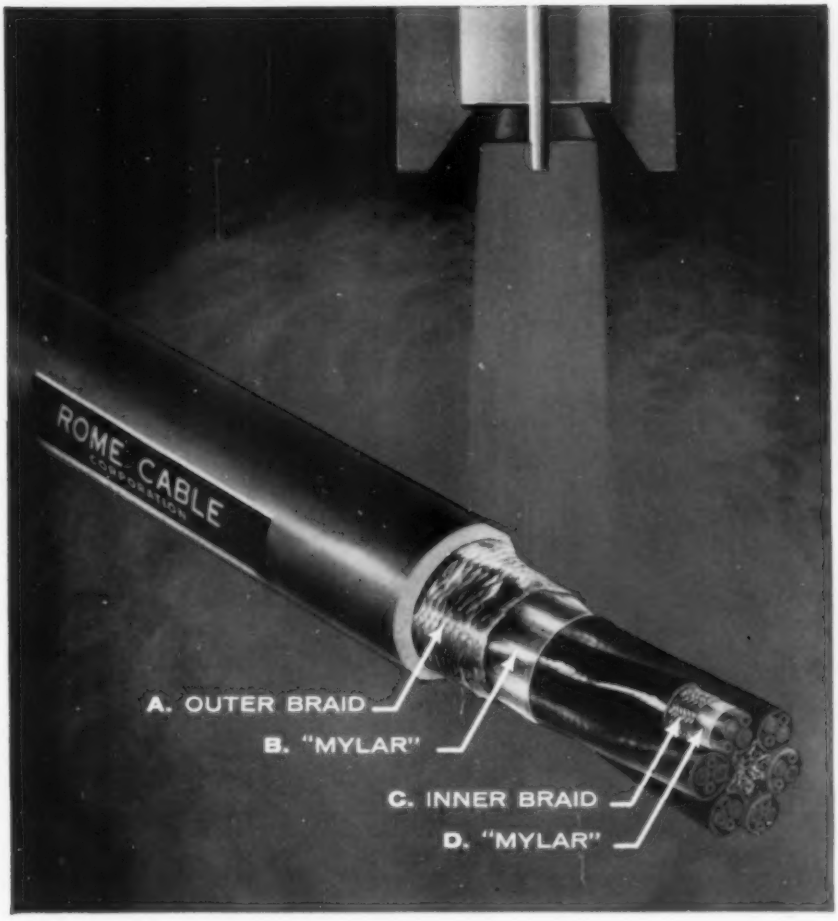

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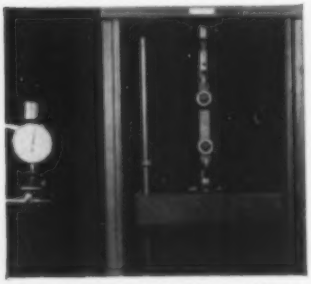
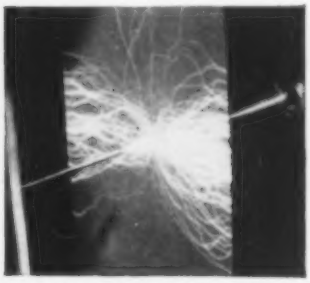


HIGH TENSILE STRENGTH. "Mylar" is strong and durable. Instron Tester shows an average strength of 20,000 psi. It's dimensionally stable . . . resists moisture.



HIGH DIELECTRIC STRENGTH. Average of 4,000 volts per mil . . . average power factor of 0.003 to 60 cycles . . . dielectric constant above 3.0 at 72°F., 1,000 cycles.

Rome Cable reports . . .

Du Pont Mylar® helps eliminate reject problem in manufacture of cable for "Titan" ICBM

PROBLEM: In designing its instrumentation cable for the "Titan" ICBM project, Rome Cable Corporation wanted a thin, abrasion-resistant tape to protect the insulated conductors from possible puncture by loose strands of the tin-copper braid (See C in illustration). They were also searching for a thin, heat-resistant core binder tape to prevent possible puncture from the outer braid (See A) during extrusion of the cable jacket.

SOLUTION: A tape of Du Pont "Mylar" polyester film for both applications (See B&D). Reason: "Mylar" has the desired balance of mechanical and electrical properties . . . it's tough, abrasion- and puncture-resistant, even in thin gauges. "Mylar" has a high melting point . . . runs well on existing machinery.

RESULTS: The two tapes of "Mylar" eliminated shorted cables due to puncture from loose strands of metal. Solving this problem has helped Rome Cable stabilize production, save money on time and materials and produce a cable that assures better performance and greater reliability in the ICBM.

How can "Mylar" help you? Whether you manufacture heavy-duty cable or tiny capacitors, it will pay you to evaluate the combination of properties found only in "Mylar". And when figured on an area basis, this tough, thin polyester film will often *cost less* than your present insulating material. For more detailed information, send in coupon.

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Application_____

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Company_____

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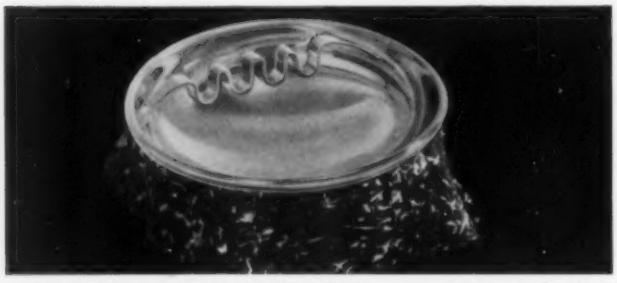
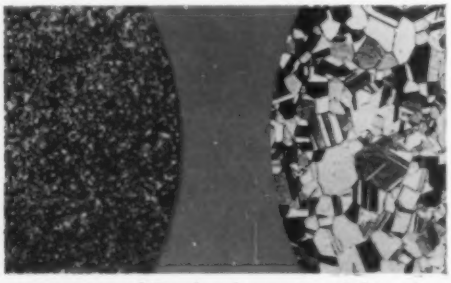
NEW BRASS SPEEDS FINISHING operations for Park Sherman Co.—Formbrite, Superfine-Grain Drawing Brass by Anaconda, reduces polishing time—cuts cost up to 50%—gives clean, easy formability.

TO THE PARK SHERMAN CO., Springfield, Ill., finishing operations are important in giving its line of fine brassware sales appeal—are also weighty cost factors. Switching from ordinary drawing brass to Formbrite, Park Sherman boosted production on the tray of this "Merry-Go-Round" Bar—25% in the cutting operation—42% in finish buff.

THE COVER of this Park Sherman Silent Butler is now made of Formbrite, Anaconda's Superfine-Grain Drawing Brass. Polishing operations in preparation for chromium plating are 50% faster than with ordinary drawing brass.



PRODUCTION INCREASED 47% in finishing operations on this Park Sherman Sta-Put ashtray after the shift to Formbrite. Products shown are only three of many Park Sherman products now made of Formbrite.



THE SECRET of Formbrite's superior polishing characteristics is its superfine-grain. Micrographs (75X): left, Formbrite; right, ordinary drawing brass.

Wherever finishing is an important cost factor in formed or drawn products, Formbrite in sheet and strip is designed to save you money. In brass wire alloys for cold-heading and upsetting, it gives a stronger, springier, more abrasion-resistant product. For more detailed information, write for Publication B-39. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

5845

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American...

DEVELOPMENTS TO WATCH...

Octane ratings will go up, but more slowly . . .

. . . during the next few years than they have in the recent past, automotive and petroleum experts are predicting.

Detroit guesses the rate of increase will be "about 0.8" units a year (as compared with the previous record of a point or more).

C. A. Cole of Ethyl Corp. told the National Petroleum Assn. last month that "a study of future US gasoline pools . . . indicates the rate of increase will drop off to about 0.4 Research octane number per year through 1962."

Future product demand could change this, of course, but indications are the rate of increase in compression ratio will also be down a bit; or, at least, will not exceed its current annual increment of about 0.5 a year.

Self-powered flashbulbs . . .

. . . with their own, built-in rudimentary batteries, are one result of a long-term research program at Battelle Memorial Institute aimed at "finding out how simple and compact a power cell can be." The "battery" is made of alternating layers of magnesium foil, absorbent paper, and silver-plated copper foil. This "sandwich" is wrapped around the base of a standard bulb; and, when moistened with water (to start the electrolytic action), will "produce sufficient power for about 20 minutes to flash a bulb." This provides time for the photographer to get set, and the energy to do the job.

There are no plans for commercial production, but Battelle's John McCallum, leader of the research team, points out that the flashbulb cell is really a modified and miniaturized version of the wartime "sea water battery,' 'and there seems no reason why it could not be produced in quantity. (For information on other new, miniaturized batteries–already on the market: *PE*—May 12, '58, *p.* 72.)

Built-in germ killer . . .

. . . that represents a brand-new approach to providing long-term protection for plastics, paper, and coated metal products, is now being readied for market. It's a vaporizing compound which seems to bear much the same relationship to standard bactericidal and fungicidal compounds (*PE*—May 5, '58, *p.* 5) as the vapor-phase corrosion inhibitors do to regular corrosion-prevention compounds. Scientific Oil Compounding Co. has a material of this type "just about out of the development stage," and shortly to reach the market. It's called *Vapor-Kleen* and is said to "completely inhibit growth of microorganisms within closed containers." Initial testing has been with such items as garbage and clothing bags, but there seems to be no reason why the compound would not be equally effective inside instruments and a good many other types of electrical and mechanical equipment.

New ways to stop corrosion . . .

. . . are coming from Atomic Energy Commission research on reactor fuels and coolants. When liquid bismuth is used as a fuel carrier in liquid-metal-fueled reactors, for instance, solution of the steel container by the liquid metal becomes a serious problem. But, says the AEC, "if zirconium is dissolved in the liquid bismuth, little or no corrosion takes place." Why? Apparently, zirconium creates a protective coating on the steel by reacting with the nitrogen in it to form zirconium nitride. In previous studies, AEC researchers found that small amounts of copper and nickel could help protect aluminum from corrosion by high-purity water. One such alloy, a nickel-containing aluminum-iron, is said to be "considerably superior" to pure aluminum in the critical 400 to 600-F range.

While plenty of emphasis is still being placed on development of alloys which are, in themselves, corrosion resistant, this approach to corrosion inhibition—using small amounts of metallic "impurities" added to the corroding medium—looks interesting.

—ARG

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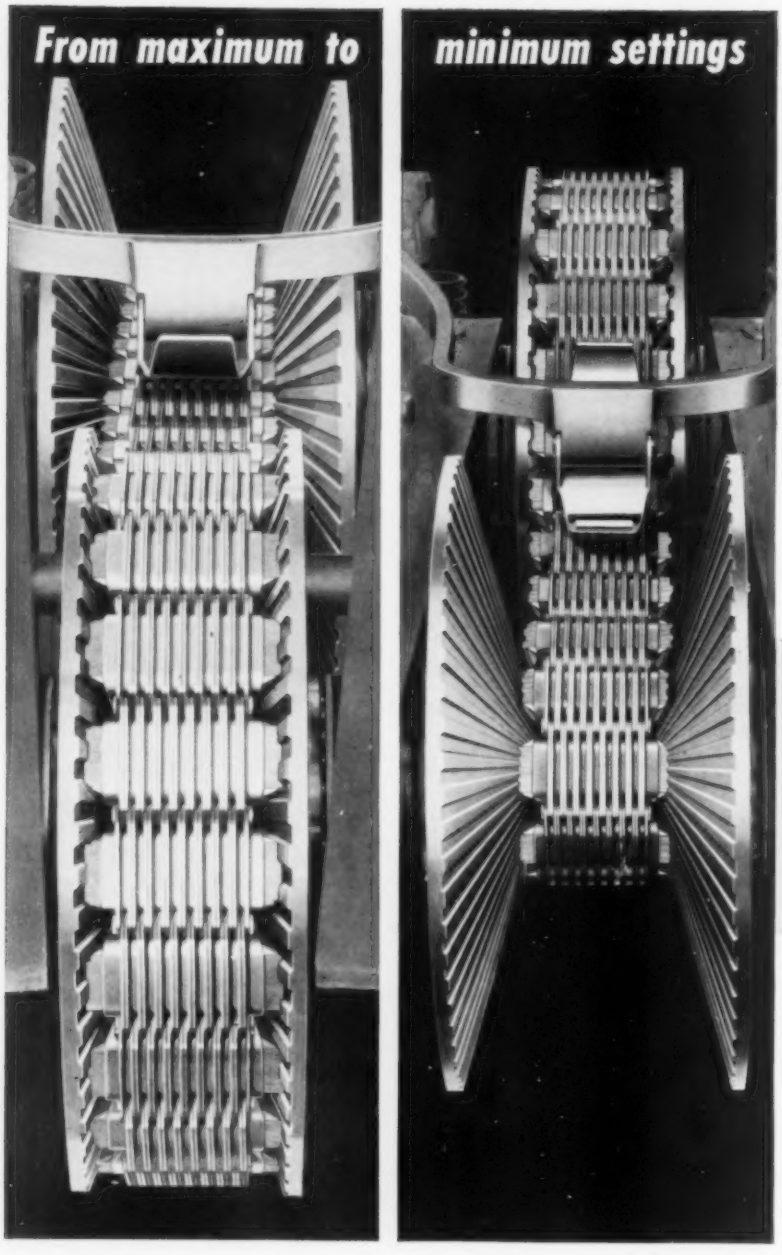

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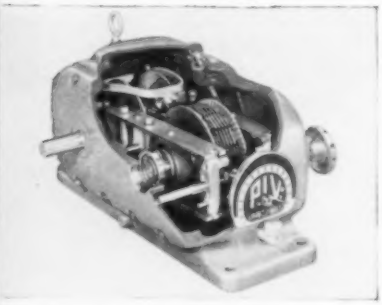

HOW P.I.V. WORKS. Exclusive self-tooth-forming chain of P.I.V. consists of packs of free-sliding steel slats which serve as teeth. Chain grips beveled grooves on pairs of conical wheels located on input and output shafts. Speeds are changed by varying the effective diameters of the wheels, as shown at left.

P.I.V. LINK-BELT VARIABLE SPEED DRIVE

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American ...Washington

DEVELOPMENTS TO WATCH...

Standardized missile ground support equipment . . .

. . . is getting a long hard look from the Pentagon in an effort to rein in rising costs of the exotic new hardware designed to store, transport, handle, test, launch, and control guided missiles.

The Pentagon's goal: to standardize as much missile ground support equipment as possible so that different missiles can use the same truck-trailers, launching platforms, shop cradles, lifting slings, cranes, and the like.

First area in which standardization will be stressed is vehicles. Well over 100 special-purpose vehicles already have been designed for transporting and handling missiles. The office of the Assistant Defense Secretary for Research & Engineering wants to limit quantity production of missiles support vehicles to models which can be used most widely. It is setting up an industry advisory committee of manufacturers, representing the truck, trailer, and aircraft industries, to make a survey of the sizes, weights, and types of vehicles designed for missile projects and to propose means of standardization.

Whether standardization of missile ground support equipment can go much beyond vehicles is debatable, however. There are some important factors which might stand in the way: the peculiar operational requirements of the four services, which are reflected in equipment design; the revolutionary development of missile weapon systems, which goes beyond attempts at standardization; the low unit output of individual missiles, which limits the dividends of standardization.

Missile support equipment is a burgeoning business. Both new orders and shipments now run over $1-billion annually. In a typical missile project, as much as 75% of the total cost is tied up in ground support gear—including costs for testing and development facilities. Even when design, development and engineering costs are excluded, a Pentagon study shows that an average missile project's costs for ground support equipment run to 40% of the total.

Electronic and propulsion equipment . . .

. . . producers are being tabbed as the major primes for future missile and other weapon systems, elbowing the airframe industry, traditional managers of the big weapon projects, to the side.

Latest evidence of the trend is Sperry Gyroscope's role in the Army's new Sergeant tactical surface-to-surface missile. Essentially an electronic company, Sperry has a production contract for the entire missile. It now makes the airframe as well as the guidance and controls. The Army says, however, this "doesn't preclude" the selection of another company —a more experienced airframe producer, presumably —to take on future manufacture of larger quantities of the airframe.

Still, Sperry might very well stick with the airframe phases of the project to the end. Sergeant is a solid-propellent rocket, needs a simpler and cheaper airframe than liquid-fuel rockets. Other contractors—like Raytheon on Sparrow III air-to-air missile—are already primes on an over-all missile system and making airframes. But Sergeant is the largest missile which an electronic firm has picked up.

Demand for new products . . .

. . . for modernization of plant and equipment, and the upsurge in industrial research are among the key factors business men list on the hopeful side of the business outlook. This demand goes on, even during the overall decline in spending by manufacturers.

To support these strong factors in the long-range situation, sentiment is growing for giving companies a better break on tax amortization—in effect, a revival of the fast tax writeoffs that helped spur one of the biggest surges of plant expansion ever during the Korean war.

Senator Capehart has already gotten support for his proposal to allow faster tax writeoffs on capital investments made during an 18-month period; the idea is to stimulate such business spending as an anti-recession measure. Other legislations favor making faster tax writeoffs permanent.

No one knows for sure yet whether any such tax legislation will be passed. Capehart's version would cost the Treasury perhaps $600 million to $1 billion at a time when the Administration is faced with increasing deficits.

World-wide ...

DEVELOPMENTS TO WATCH...

To reduce wear . . .

. . . on bearings, pump parts, pistons, impellers, gears, cutting tools, and rotating shafts, a British company has developed a process for which it makes quite a series of claims.

The treatment is "a molecular penetration by a thermochemical process" which can be applied to practically all metals (including titanium) and to tungsten carbide, ceramics, plastics, rubber, leather, wood and fiber products, the company says.

According to its developers, the treating compound is nontoxic, chemically inert, and anti-corrosive, and will not affect the electrical resistance, hardness, or dimensions of treated parts. The treatment is also said to be effective over a temperature range from −125 F to 1650 F (3600 F under some conditions); and to be able to stand almost any pressure the base material can take.

A company, Prorega, Ltd., South Ward Road, Dundee, Scotland, has been set up to apply the process to parts shipped on consignment for the purpose; but, the developers say, "where volume of application merits it, we will be pleased to discuss the supplying of facilities as an integral unit within the user's own plant."

Treatment costs depend on part size and thickness. For example, Prorega charges about 14¢ for treating ⅛-in. drills; $1.45 for the 1⅛-in. size. That sounds like a lot; but treated tools of this type are said to last at least 8 times as long; and production increases as high as 1600% have been recorded.

An automatic locking device . . .

. . . for the accelerator pedal, and an automatic clutch that can be installed on cars already in use, have been developed in Germany.

The locking device is an electromagnetic unit which is said to lock the carburetor in any desired position, yet not to interfere with safety. It consists of a battery-operated electromagnet, controlled by a pushbutton which actuates a brake pulley. The cable around the pulley runs to the throttle lever and holds it in whatever position it had when the energizing button was pressed. A second circuit, wired across the cutoff contact, deenergizes the circuit and neutralizes the locking action "at the slightest touch of the brake, clutch or accelerator pedal." Prufex Elektro-Apparatebau GmbH, Cadolzburg/Furth developed it.

The automatic clutch is basically a mechanical drive, devised by Fichtel und Sachs A.F., Schweinfurt/Main. It consists of a centrifugal clutch, actuated by a servo-controlled diaphragm. The diaphragm is directly connected to the gear lever, and the servo-system operates a valve interposed between the diaphragm chamber and the intake manifold of the engine. Since the valve receives its control pulses directly from the gear lever, only the speed of the engine can affect the clutch.

The world-wide demand for control equipment . . .

. . . is pointed up by this photograph of a brand-new ethylene oxide plant in Germany. Temperature, pressure, and volume of flow are all controlled automatically, with valves being operated by servomotors. The plant is one of a group at Chemische Werke Hüls to produce chemicals and plastics for the automotive, textile and drug industries. The company is now completing a fully automatic, 50,000-ton "cold rubber" plant based on an American process. It's scheduled for operation in late summer or early fall.

Automatic processing keynotes new German plant. Entire chemical operation is controlled from this carefully arranged nerve center. —ARG

You can actually see the quality in products made of SHARON STAINLESS STEEL

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SHARON, PENNSYLVANIA

476

What's happening in SCIENCE

How to lighten the load

Structural weight will have to be cut 25% if space travel is to become practical, E. E. Sechler told a recent session of the University of California's Space Technology Symposium. For nearly two decades, he pointed out, structural weight has hovered between 25% and 30% of take-off gross weight, in both military and commercial aircraft. But in a space vehicle, only 3% to 6% of the gross weight can be spared for this purpose.

What to do?

One possibility is to design shrinking fuel tanks. "Assuming presently known propulsion systems," says Sechler, "the largest weight item will be that of the propellants. Since the propellants will be consumed during flight, it is obvious that the ideal propellant container would be one that reduces in size and weight as the propellant is utilized."

The staging systems now used attempt to meet this need. But they leave much to be desired.

The lightest pressure vessel possible would be a sphere, pressurized by the hydrostatic head of the liquid fuel or by pressure of the burning solid propellant gases. But it's hard to combine a number of spheres so that they form a carrier for the payload and control package, and yet can be successively staged when empty.

The optimum propellant container, Sechler thinks, will turn out to be a series of cylinders.

How does one design a cylinder that will support the weight and acceleration forces of the structure above it as well as the shear and bending moments that occur during flight? One method would involve internal pressurization. But this increases critical buckling stress of the shell. Another way—and a promising one—is using honeycomb materials to give a relatively rigid double-shell unit. Perhaps the most interesting method, though, is one made possible by solid fuels: using the fuel itself as stiffener. However, while the fuel would support the shell on takeoff, the shell might have to be fairly heavy to withstand forces of the gases evolved by the fuel when it starts to burn.

The final answer has not yet been found. New materials may help to ease the problem. But Sechler holds out more hope for a solution that involves better ways to utilize existing materials so as to eliminate points of stress concentration. He believes "the success or failure of the space vehicle will largely depend on more accurate structural analysis so that all excess weight is eliminated without reducing the strength or safety of the vehicle."

Cheaper atoms for product use

Price reductions, long promised by the AEC for five important radioactive isotopes have at last been put into effect, though the new plant expected to produce them in quantity has not yet gone into operation. Originally scheduled for early spring, it's now expected to be ready sometime this summer.

The five isotopes are cesium 137, dropped from $14 to about $2 a curie; promethium 147, down from $500 to about $3; cerium 144, $1,000 to $2; strontium 90, $500 to $10; and technetium 99 drops from $1,000 to $140 or less a millicurie.

For ideas on how to use these radioactive materials, in thickness gages, luminous markers, batteries, and the like, see *PE—Sept. 16, '57, p. 9; Oct. 7, '57, p. 6; Nov. 18, '57, p. 13; Feb. 10, '58, p. 7; Apr. 14, '58, p. 52.*

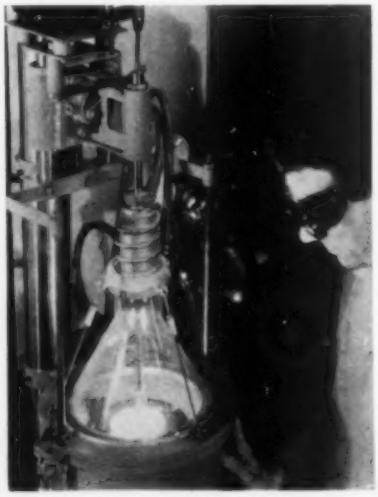
Space briefs . . .

Meteor dust erosion will be a serious space-flight problem, according to some authorities, R. B. Dillaway of North American Aviation's Rocketdyne Div. reports. Some estimates put the possible erosion figure as high as 0.01 in. for each hour of space flight. On a trip to the moon, that could easily mean no plane, long before the destination was reached.

Maser telescope designed by Naval Research Lab and Columbia U. Dept. of Physics may give man his first view of outer space. A synthetic-ruby maser amplifier, built at Columbia, has just been installed on NRL's 50-ft radiotelescope, and is expected to increase its sensitivity at least 10-fold. That should make it possible to probe at least three times as far into outer space as ever done before. First use of the maser telescope though, will be to study relatively close objects like the planet Venus where increased sensitivity will mean greater accuracy of measurement. (For more information on masers, see *PE—Jan. 13, '58, p. 10* and *Mar. 31, '58, p. 36*). —ARG

For home-grown crystals

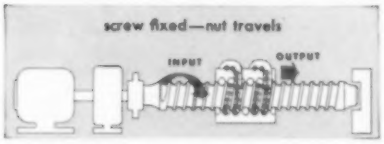
Make your own silicon and germanium crystals for research, suggests NRC Equipment Corp. The apparatus shown here will do it. NRC says this lab-sized furnace takes less than 400 sq in. of floor space, yet can produce melt temperatures to 2800 F (controllable to about 2°), and has a crucible capacity of more than 9 cu in., with a pulling length of 12 in. Standard parts are used throughout and carry a full-year warranty. Complete unit, including power supply, costs $4210.



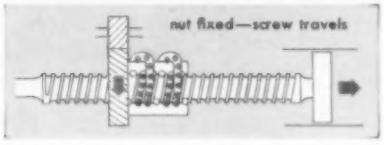
Here's your new ANSWER

PHOTOGRAPHED ACTUAL SIZE
BALL CIRCLE DIAMETER: 3/16 inch.

WORLD'S SMALLEST ball/bearing SCREW SOLVES CRITICAL MINIATURE POSITIONING/CONTROL PROBLEMS



NUT TRAVELS: When rotary motion is applied to the screw, the b/b nut glides along the axis of the screw on rolling steel balls, converting rotary force and motion to linear force and motion with 4/5 less torque than acme screws.



SCREW TRAVELS: When rotary motion is applied to the b/b nut, the screw glides along its longitudinal axis on rolling steel balls, converting rotary force and motion to linear force and motion with unprecedented efficiency.

An unprecedented achievement in minimum size and weight—maximum efficiency, dependability and service life for ultra-precise controls.

It's another first from Saginaw—and the possibilities it opens up for improved electrical and electronic controls are limited only by your imagination! Radar tuners, missile and rocket guidance and telemetering systems, automatic switchgear, electronic machinery controls are just a few of the applications where this new miniature Saginaw b/b Screw will solve critical positioning/control problems. *It's so compact and light,* you can save substantially on space and weight. *It's so efficient,* (over 90%) you can use much smaller motors and gear boxes. *It's so precise,* you can position components within .0005 inch per inch of travel. *It's so dependable,* you can rely on remarkably long service life even in adverse environments.

You will find our 1958 Engineering Data Book extremely helpful in planning applications, or experienced Saginaw engineers will gladly make specific recommendations without obligation. Just phone, write or mail the handy coupon.

See our display booth #434 at the Design Engineering Show

Saginaw

ball/bearing Screw

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WORLD'S LARGEST PRODUCER OF BALL BEARING SCREWS AND SPLINES

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General Motors Corporation
b/b Screw and Spline Operation
Dept. 7PER, Saginaw, Michigan

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New magnet wire ready

The anodized aluminum magnet wire for use at temperatures to 500 F or more, produced by a new continuous process (*PE*—Mar. 17, p. 17), is now on the British market, and more information is available on prices and properties.

The producer, Aluminum Wire and Cable Co. Ltd., Port Tennant, Swansea, is offering it in wire gage sizes from 16 to 36 (0.064 to 0.0076 in. dia) at British prices of 65 to about 130 pence (roughly 70¢ to $1.50 a lb). AWC says that, besides excellent heat resistance, the material has good heat-treansfer qualities and the following electrical properties:

Room temperature resistance per 1,000 ft ranges from 4.19 ohms for the #16 size to 320.8 ohms for the #36. At room temperature (20 C), the constant-mass temperature coefficient of resistance is given as 0.00403 per °C. Breakdown voltage is stated at "not less than 200 rms."

Number of turns obtainable per inch for wire of max dia is quoted at about 15 for the #16 wire; and 130 for the #36 wire. (There are about 29½ ft in 1 lb of the #16 wire, and 2090 ft in the #36.)

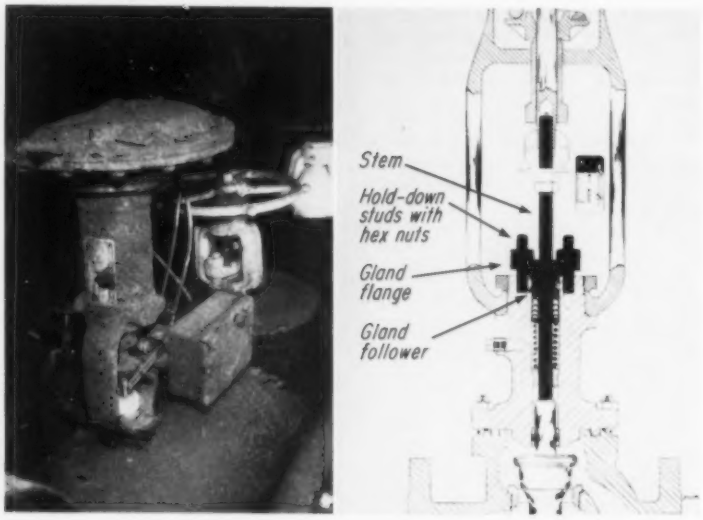
In winding, the company recommends using plastic pulleys with radiused grooves, max tension of 2½ tons psi, and bend radius of not less than 15 times dia of the wire.

Field widens for powdered metal

The slip-casting process for producing larger powdered metal parts is more than living up to expectations. Dr. H. H. Hausner, who first described the technique (*PE*—Oct. 7, '57, p. 6) now reports that it not only allows producing larger stainless steel powdered metal parts at surprisingly low cost, but looks promising as a method for increasing the strength and ductility of several other metals.

For this reason, researchers at such companies as Union Carbide and General Electric are trying out the method on such metals as tungsten, chromium and molybdenum. Reports on work with at least two of these are scheduled for the AIME conference on Reactive Metals, at Buffalo, May 27.

The slip-casting process is basically the slurry method long used to "cast" ceramics. But as a substitute for compacting in the fabrication of powder metallurgy parts, slip-casting is brand-new. One example of the savings possible, cited by Dr. Hausner at the Metal Powder Assn. meeting is that of a stainless steel plate which, fabricated by conventional methods, would have required a $6,000 die, and a 1200-ton compacting press. The part was slip-cast in a $30 mold—with no press needed.



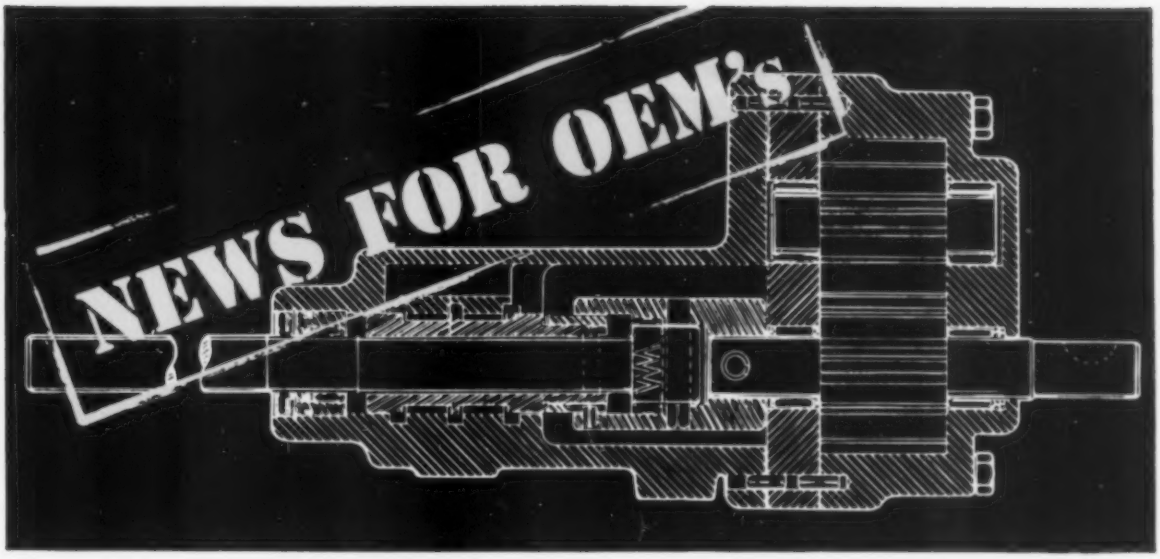
Zirconium gets a production job in automatic control valves at Columbia-Southern Chemical Corp. When other metals failed in liquid chlorine service, C-S tried Columbia-National zirconium components for packing gland, studs, and nuts (items shown in black in diagram at right), reports they outlast even stainless steel—stand up 4 to 20 times as long.

briefs . . .

Amosite asbestos, used for high-temperature insulation and fireproof partition board, still heads the list of critical materials. Though many once-short metals are now in ample supply (see p. 10), and the stockpile of other types of asbestos is in good shape, even minimum objectives have not been met for amosite. According to the latest Stockpile Report, there is only one supplier (the Union of South Africa), and the long-term outlook is such that the Department of Defense has included amosite in its directive on conservation, which requires the military departments to develop suitable substitutes in all major uses.

New organometallic compounds are promised by Metal & Thermit Corp. as it dedicates its large-scale Carrollton plant. First production will be of organotin compounds (*PE*—Apr. 7, '58, p. 5), but a new group of zinc, cadmium, and phosphorous compounds is being readied for use in plastics, rubber, fuels, and flame-retardants.

Man-made diamonds get a new commercial job at Carborundum Co. It is introducing a line of metal and vitrified bond grinding wheels using the GE synthetic diamonds in grit sizes up to 100. Carborundum says they'll "supplement natural diamonds for grinding carbides and other materials requiring the unusual grinding properties of the diamond." —ARG



NOW! *Expanded production makes* HYDRAULIC SERVO MECHANISM

available to MORE original equipment manufacturers

Originally known as the Behlen Powr-Steer, this advanced rotary type hydraulic servo mechanism has proved highly successful on thousands of farm tractors of many models and makes. Behlen was first to offer power steering for row crop tractors, five years ago. For the past two years, Powr-Steer has been used on a leading farm tractor line as original equipment. Demand soon outstripped our production capacity.

Now Behlen production facilities have been expanded to the point where we can offer our Hydraulic Servo Mechanism to a wide field of manufacturers of industrial heavy construction and agricultural equipment. From tractors to earth-movers. From fork-lift trucks to power shovels — every type of equipment where manual labor needs to be reduced.

In supplying the hydraulic "muscle" of Behlen's servo mechanism to your product, you will add magic to its sales appeal.

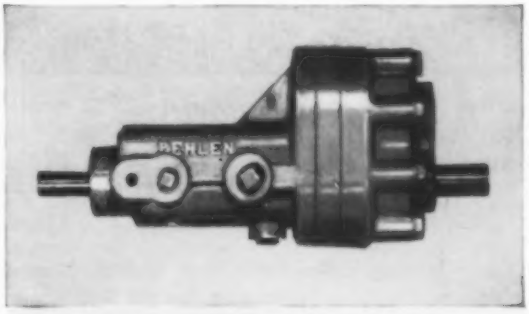
We invite you to see how easily the Behlen Hydraulic Servo Mechanism can be applied to your products as original equipment (or as extra equipment readily installed in the field). Your request (which will not obligate you in any way) will receive the personal attention of our production manager, Howard Christenson.

Phone, write or wire

BEHLEN MANUFACTURING COMPANY

Dept. PE-5 Columbus, Nebraska

World's largest manufacturer of tractor and grader power steering



The Behlen Hydraulic Servo Mechanism, Rotary Type, Series 2000, can be used for power steering or wherever a rotary servo motion is required. Controller and actuating parts are in one compact unit, for economy and simple installation.

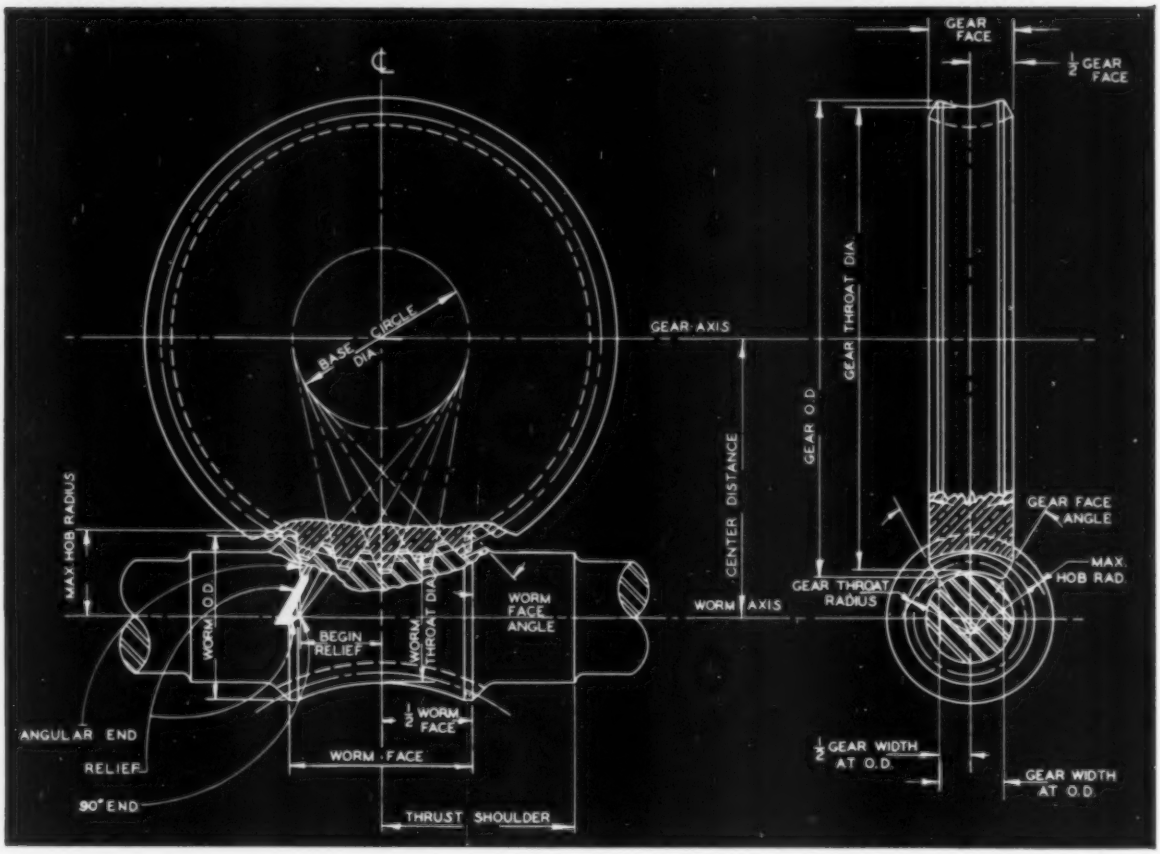
FULL 360° OPERATION

The Behlen unit is a gear-type hydraulic mechanism (in contrast to the piston type on passenger cars and other equipment). The power source in the unit is a gear motor that will provide continuous 360° turning under full power in either direction.

The power unit is mounted anywhere along the steering shaft. While the Powr-Steer operates as a servo mechanism between steering source and wheels, it also blocks and controls wheel shocks. Does not affect steering ratio. Maintains full and positive control through mechanical linkage in event of hydraulic power failure.

Specialized engineers in our Hydraulic Division are ready to adapt Powr-Steer to your specific needs in any of hundreds of machinery and equipment applications.

WORM GEAR DESIGN . . . *Bulletin #200*



Bulletin 200 has 20 pages crammed with 38 formulae, such as the Formula for Class I AGMA Horsepower Rating:

$$P = K_s K_m K_v \frac{n}{mg}$$

Step-by-step instructions, with typical examples, enable you to quickly determine the size worm gearset you need to meet any horsepower and service required.

You can calculate the bearing loads and sizes needed for the worm and gear shafts.

You can check the worm root stress and gear tooth stress.

Efficiency is charted against helix angle with modifications for required speed so you can quickly determine efficiency.

One quick look at the drawing above will convince even the uninitiated that no other worm gearset has so many teeth in contact. No other worm gearset is so simple to design and rate. No other worm gearset will carry so much load in so little space with so little weight.

Now, Bulletin 200 provides complete design and application data on space-saving double-enveloping worm gearing. Ask for it without obligation.

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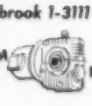
DOUBLE-ENVELOPING WORM GEARSETS

DOUBLE-ENVELOPING WORM GEAR SPEED REDUCERS

DOUBLE REDUCTION WORM GEAR SPEED REDUCERS


DOUBLE-ENVELOPING RIGHT ANGLE GEARMOTORS

MAY
1958

Dow

Plastiatrics

DOW'S CLINICAL APPROACH TO HEALTHY PLASTICS APPLICATION

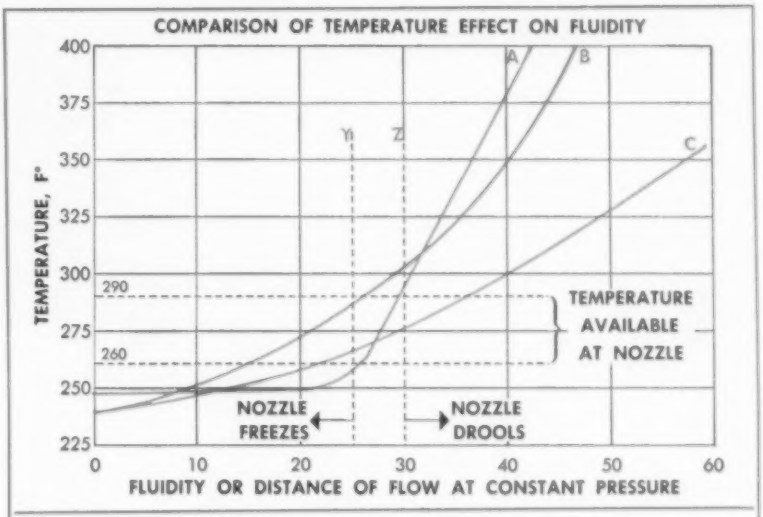
MOLDING CHARACTERISTICS OF POLYETHYLENE AND POLYSTYRENE STUDIED

NEW STUDY AIMED AT REDUCING COMPLEXITY OF MATERIAL SELECTION FOR HOT RUNNER AND RUNNERLESS MOLDING

Careful selection of the materials to be used for hot runner and runnerless molding is extremely important. Both polyethylene and polystyrene exhibit characteristics which are desirable, and various formulations of both materials are widely used for hot runner and runnerless molding. To help plastics fabricators select the right material, Dow Plastics Technical Service Engineers have conducted a series of exhaustive tests on polyethylene and polystyrene and have arrived at the following list of properties which might be desirable for this type of molding:

1. Temperature sensitivity and easy flow at low temperatures.
2. Pressure sensitivity and easy flow at low temperatures.
3. High heat distortion temperature, thus permitting quicker ejection from the mold.
4. A high rate of thermal conductivity to remove the heat rapidly from the material.
5. Low specific heat, thus requiring less time to solidify.

These characteristics are summarized in the chart illustrated at right.



The materials shown, A, B & C, have approximately the same heat distortion temperature. All molding conditions except temperature are held constant. The material in the nozzle must have enough fluidity to flow under the given pressure of 16,000 psi, as indicated by the vertical line Y. A material having fluidity greater than 25 but less than 30 will flow under pressure and will not drool as pressure is released. If the fluidity is greater than 30, drooling will occur.

Material A has a wide softening range and becomes very fluid as the temperature is increased from 245°F. to 255°F. It will neither freeze nor drool at the nozzle or secondary sprue operating at temperatures from 260°F. to 290°F.

Material B is stiff flowing and would freeze in the nozzle until the temperature is increased to above 290°F. The plastic would drool out of the nozzle if the temperature is increased to above 300°F. This is a much narrower temperature range than material A and closer nozzle temperature control would be required.

Material C would also require a narrower nozzle temperature range than material A because it is more temperature sensitive. With the nozzle varying in temperature within the indicated limits, material C could either freeze or drool. The nozzle temperature would have to be very carefully controlled to operate from 270°F. to 275°F. to successfully run material C.

Obviously, material A would be the easiest to run because it has less change in fluidity with small temperature changes.

Plastiatrics studies on this and other phases of plastics formulation, design, molding and finishing continue under the direction of Dow Plastics Technical Service Engineers. For your copy of the paper entitled "Molding Materials for Present and Future Molding Techniques", or for further information on these Plastiatrics studies, write THE DOW CHEMICAL COMPANY, Midland, Mich., Plastics Sales Dept. 1522D.

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GENERAL PURPOSE
- STYRON® 666
- STYRON 666M (Easy Flow)
- STYRON 665 (Extrusion)
- STYRON 689 (Easy Flow)

HIGH IMPACT
- STYRON 475
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- STYRON 777 (Medium Impact)
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- STYRON 440M (Easy Flow)
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HEAT RESISTANT
- STYRON 683
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PROBLEM:

To insure top operating efficiency in helicopter windows.

SOLUTION:

Mounting of windows on Grant Slides.

An Army helicopter must operate at top efficiency at all times. Vital observation missions, dropping of supplies, rescue work, are just a few of the "whirlybird's" everyday duties. The side windows of the pilot's cabin - opened and closed repeatedly during these duties - must operate smoothly and easily. They must work at peak efficiency despite the strong vibrations of the ship, adverse weather conditions, changing temperatures; they must not jam; they must operate for a long time under all conditions. Sikorsky Aircraft specified Grant No. 350 Series Slides for the windows of the Army's H-37 twin engine helicopter and the 350 is proving itself worthy of this specification. Dependability, ease of operation and long life are built into every Grant Slide!

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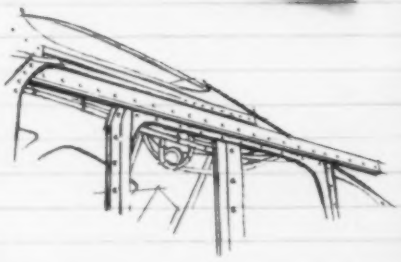

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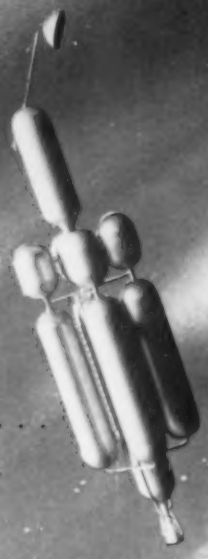
Crutches won't help cross a design roadblock



For lunar reconnaissance . . .
Chemical rocket—it jettisons outer tanks.

Nuclear interplanetary vehicle . . .
Hydrogen ions heated by nuclear pile.
Crew in head. 400 ft long.

Experience in design was once the best teacher—but it isn't any more. Design is, to an increasing extent, concerned with new materials, components and conditions. Much of this trend has come about through defense requirements, but some is the result of our accelerating technological development. The result is an alarming increase in the number of roadblocks between concept and completion. In many instances, the finding of a way to pass the roadblock is complicated by a time limitation. And the real roadblock is often not the apparent one but antiquated thinking.

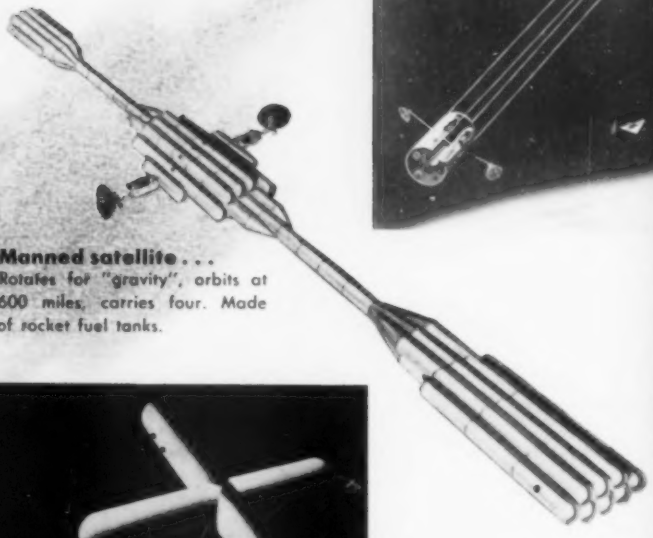
The trouble is that we think in familiar terms; we try to solve the new problem on the basis of experience gained in the old. This is logical, reasonable, traditional. When the pace of development was slower, new ideas grew out of the old; the real breakthroughs into new areas were infrequent.

The accompanying pictures are, however, illustrative of the change. All are designs by Krafft A. Ehricke, asst. to the technical director of Convair-Astronautics. A few years ago, they were pure science fiction, "unworthy" of the practical mind. Now a number of practical minds are working on them and they are on a time schedule only 20 years long. Space flight is a spectacular example, of course, but there are more prosaic ones. All of our concepts of speed, time, space, heat, cold, strength and other relationships are in a state of flux.

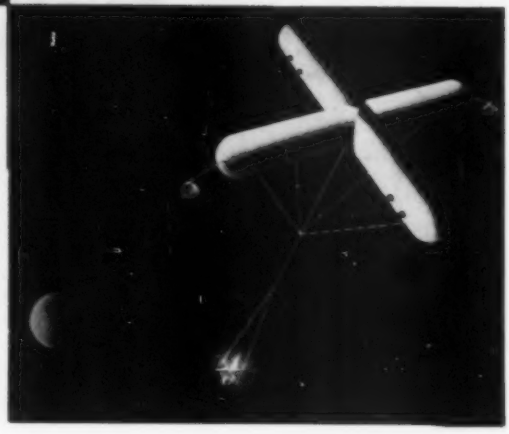
This has the effect of tearing loose the anchors of experience, of security. Our early lives, our college training, and our technical experience all establish the limits of the things that can be done. But each day someone announces destruction of another design boundary.

I remember discussing with my inventor father one of his ideas—that of using the vacuum in an engine intake manifold to operate a windshield-wiper motor. (This was over 30 years ago, when wipers were still hand-operated.) I had just completed my sophomore year in engineering. From the depths of my educated ignorance, I explained carefully to this fifth-grade graduate why his idea was impractical. I was quite

Space ferry for lunar cargo . . .
never lands, so structure and instruments are light. Cargo is dropped from head between inflated dome-shaped tubes (top right), rolls near space station.



Manned satellite . . .
Rotates for "gravity", orbits at 600 miles, carries four. Made of rocket fuel tanks.



This ship is one . . .
of many that could be assembled at a satellite. Space between nuclear power source and ship protects crew.

3-stage supply ship . . .
130 ft, chemically powered, carries five to a satellite with rocket-glider return.

certain that the idea would upset heat balance of the engine as well as its economy. He accepted my explanation, but said, "It seems to me that college has taught you mostly what *can't* be done!" He put his finger on the dangerous characteristic: education and experience and teach us only what we *cannot* do.

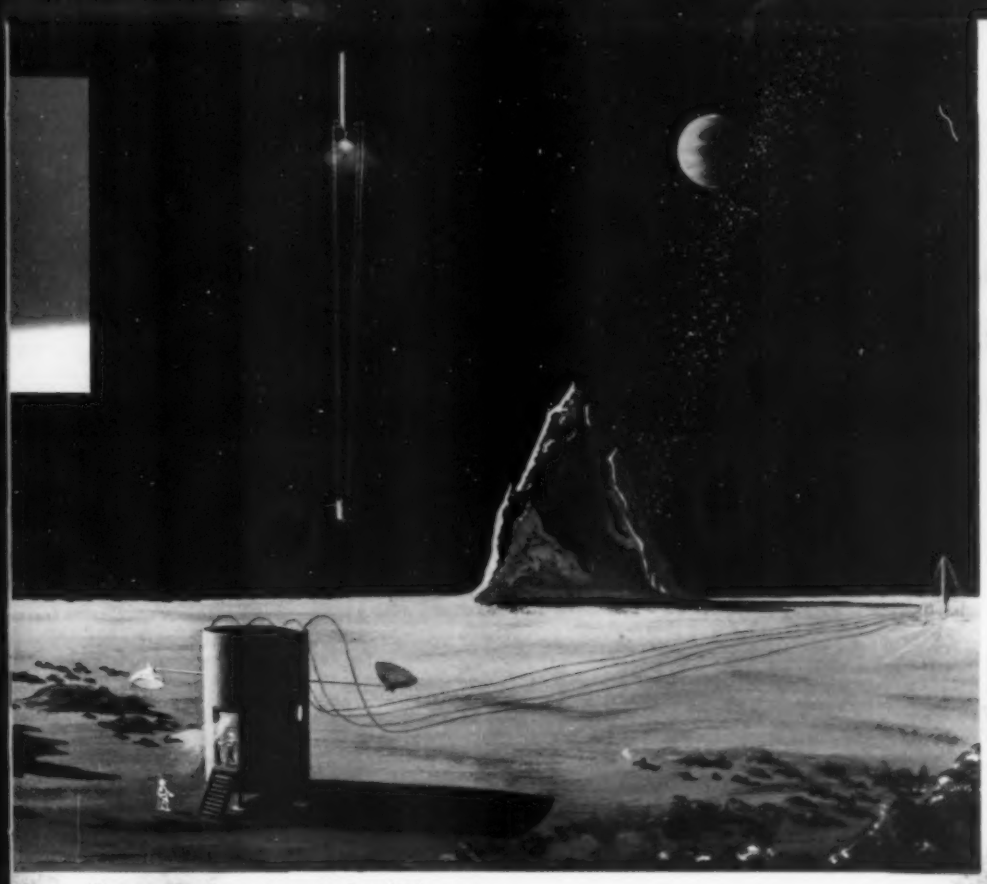
This is probably unavoidable, because technical education is a process of providing accumulated knowledge in capsule form. And much of this knowledge is of necessity outdated as time goes by. The thinking instructor is, of course, attempting to teach a way of approach to a problem, to teach the student how to think for himself rather than to accept the thinking of others. But, testing of student knowledge may be done on the basis of milestones in earlier thought, so the instructor may provide the lazy mind with crutches that become parameters. It is the rare mind that can use the experience of others as a jumping-off place for original thinking.

As Mark Twain once said, "A cat that once sits on a hot stove lid will thereafter never sit on a stove lid again, hot or cold." Likewise, the student who learns that certain limits have been established, and who is expected to memorize those limits to pass examinations, is likely to fix them permanently in mind. Then there comes the day when he encounters heavy water, high-purity metals with fabulous tensiles, materials that do not act like steel, or wood, or concrete, extremes of heat and cold that make materials act in totally new ways. He is understandably all at sea.

John Arnold taught a widely discussed course at MIT a few years back. Planned to lead to creative thinking, it required students to design equipment for use on a planet Arcturus, with beings, atmosphere, temperature, and other factors different from those on earth. Some of the designs were startlingly ingenious, some showed the limitations of earth thinking, but at least the students were temporarily forced into thinking in unfamiliar terms.

The extremes of heat and cold are *not* simply extrapolations of normal temperatures, any more than are those of machining and forming speeds. Many materials do the unexpected at extreme temperatures. A punch fired by a gun will punch or form metal that shatters at normal press speeds. So, too, cutting and forming of titanium and some high-strength steels can be done at subzero temperatures easier than is possible at room temperature.

Krafft Ehricke (see pictures), says that the accepted idea among scientists of huge space platforms as jumping-off places for trips to outer space may now be abandoned. Intercepting nuclear warheads could knock out any platform intended for military purposes. This



Chemo-nuclear-powered vehicle . . .
would be capable of landing a 7½-ton payload on the moon and returning, or of orbiting a 15-ton payload around Mars. First stage is 90-foot delta-wing glider (going back in small sketch) with rockets developing 2.7 million lb of thrust. Approaching the moon (large drawing, earth at top right), the hydrogen-fed nuclear engine tows a crew gondola by 1000-ft cables, sets it down first, then lands itself at radiation-safe distance.

Solar-powered explorer . . .
has twin heat collectors of inflated polyethylene to heat hydrogen fuel.

Nuclear interplanetary explorer . . .
has 8-man crew, satelloid to probe planet atmosphere, robot maintenance unit.

makes such a platform suitable only for a weather station, a television or communication relay, or a tourist attraction. We can throw away this crutch because of advances in space technology.

He has also pointed out that assembling space platforms and vehicles with accepted joining methods is outmoded. Even magnetic joints are possible where there is so little air resistance.

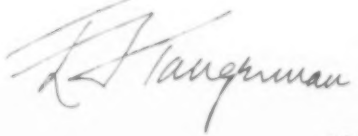
But let us come to more prosaic examples of our fading boundaries. One researcher wanted a 50-hp, 50,000-rpm infinitely adjustable-speed motor for direct drive of a test lathe for high-speed machining tests. Another sidestepped the roadblock by literally shooting the toolbit across the work; he obtains speeds up to 166,000 sfpm by firing the toolbit from a rifle. In another case, a camera shutter that operates in a billionth of a second was obtained by abandoning conventional mechanical motions and going to a liquid that is normally opaque but becomes clear under electrostatic charge.

One West Coast engineer echoes an ancient complaint, "Why does design for other materials follow design for steel?" Oldsters will recall the same plaint in the early days of weldments, which attempted to follow cast design, or the plastic parts that were merely carbon copies of metal ones. Or the still earlier days when stone was sculpted in the elaborate patterns that characterize wood sculpture and castings were full of tracery because that was considered art.

Perhaps this is the basic roadblock: public taste. We learn that a piece of a certain shape and size has a certain strength in steel or cast iron, so we make the piece in other materials the same way. Or we learn that a certain shape is aesthetic, so we design to that shape whether it is suitable to the use or not. Current examples are legion: The autos that look like, and are named after, airplanes. The appliances and machines that are "streamlined" or "teardropped" or "blocky" or "massive" to suggest characteristics that are neither incorporated nor necessary. The car doors designed to slam with a heavy "clunk" instead of a lighter "click"—or no sound at all, because the "clunk" sounds substantial.

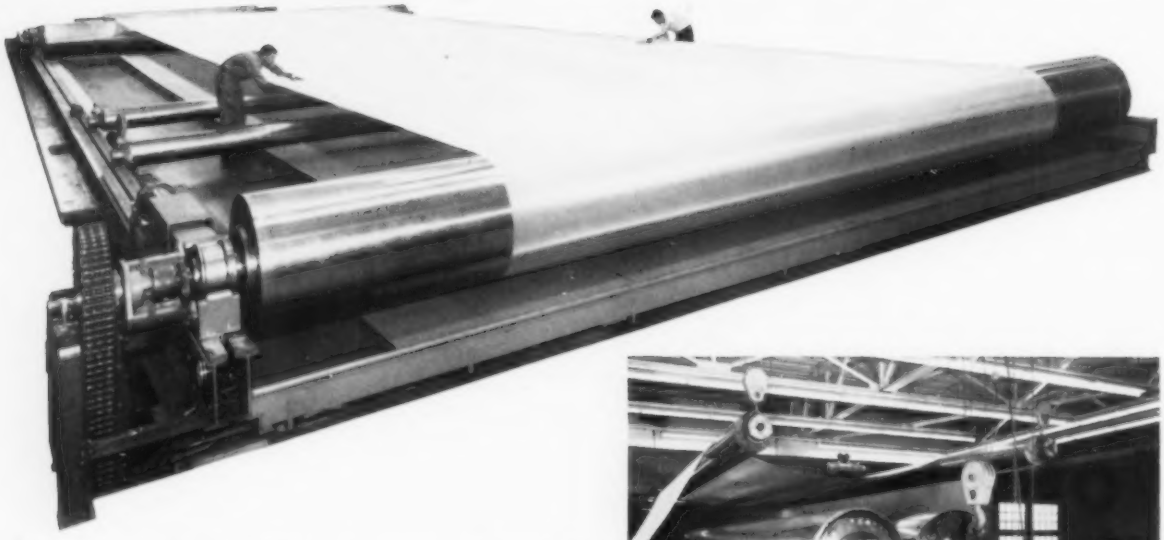
This is another form of crutch—designing the new to the standards of the familiar. It mates the crutch of designing *for* the new *with* the standards of the familiar.

It may be heresy to say so, but unless we free our design concepts from such crutches, our economy and our civilization will be mentally muscle-bound.



In specialized applications...

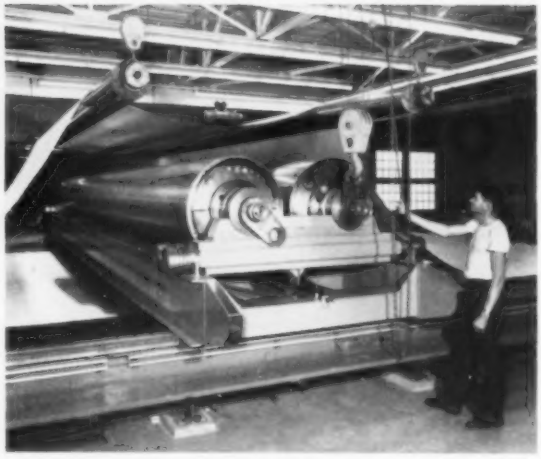
ACIPCO CENTRIFUGALLY SPUN STEEL TUBES



Appleton Wire Works, Inc., manufactures high quality fourdrinier wires for paper making machines. These fine-mesh wires are woven in widths up to 340 inches and lengths over 180 feet.

At its Montgomery, Alabama, plant, Appleton Wire Works, Inc. uses ACIPCO steel tubes— centrifugally spun and polished at Acipco—as stretch rolls on the huge finishing table. These 35.625″ OD, 410″ long rolls must be both dimensionally stable and balanced and must have a polished surface which will not affect the delicate woven wire surface mechanically or chemically.

Here is another example of Acipco versatility. If your application requires heavy wall steel or alloy iron tubes with special physical, chemical or metallurgical properties "built-in," Acipco can serve you. Investigate Acipco's complete "one source—from start to finish" facilities. A call or letter will bring full information on Acipco centrifugally spun tube applications in your field.



VERSATILE ACIPCO CENTRIFUGALLY SPUN STEEL TUBES

Size Range: Lengths up to 410″ to meet modern machinery requirements have been produced. OD's from 2.25″ to 50″; wall thicknesses from .25″ to 4″.

Analyses: All alloy grades in steel and cast iron, including heat and corrosion resistant stainless steel, plain carbon steel and special non-standard analyses.

Furnished: As cast, rough machined, or finished machined, including honing. Complete welding and machine shop facilities for fabrication.

SPECIAL PRODUCTS DIVISION
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ACIPCO

Aircraft Firms Gird for Space Travel

Atlas Could Power 4-man Space Station 400 Mi. Away by 1963

SAN DIEGO—A 4-man experimental space station could be established in permanent orbit 400 miles above the earth within five years by giving Atlas intercontinental ballistic missile another job.

This has been proposed by Convair (Astronautics) Division of General Dynamics Corporation and conceived by Krafft Ehricke, assistant to the technical director of Convair-Astronautics. The Atlas manned space station would be the primary unit of a complete Atlas orbital system. In addition to the space station, the system would include a cargo ship and a four-passenger ferry vehicle.

Derived from the Atlas ICBM now in pilot production at Convair-Astronautics in San Diego, Calif., the project capitalizes on the fact that the Atlas, relieved of its warhead and associated weapons equipment, is the only U.S. rocket vehicle capable of orbiting the complete primary structure of a manned space station in a single launching, as a means of proving at an early date man's adaptability to long-term existence in space.

FOUR REQUIREMENTS

Creation of a manned space station, consisting basically of a lightweight stainless steel shell—the modified propellant tankage of the Atlas missile—could be accomplished with fulfillment of four basic requirements: (1) performance; (2) reliability of operation; (3) count-down precision, and (4) adequate re-entry capability for returning personnel.

As the most powerful booster now under development in the United States, the Atlas already fulfills the performance requirement. By itself, this performance is sufficient for launching the basic space station into space.

With the addition of a second smaller upper stage, about 8,000 pounds of cargo or a crew of four can be delivered into space.

Four flights in flight . . .
Here's model Convair predicts will be a reality by 1963 when an Atlas ICBM will power a 4-man station to its destination 400 miles from earth. Crew depicted in above photo would live and work in forward tankage of the Atlas. Note washroom in bottom compartment, eating and recreation in next compartment, sleeping area next and at top is instrumentation

Northrop Also Has Ideas for Vehicle to Hurdle Space

HAWTHORNE, CALIF.—Northrop Aircraft's engineers say that within three years they could design a vehicle to carry man into an orbit 200to 300 miles from earth. They will propose a manned space program to the government "as soon as the appropriate space agency is established."

At the same time, Northrop vice-president George F. Douglas emphasizes that any such project should be carried out parallel with development of present aeronautical weapons. An enormous quantity of detailed engineering information lies between demonstration that a space vehicle is possible and actual construction of hardware. Concentration on a manned project to the exclusion of perfecting existing weapon systems would lead to lopsided distribution of the nation's resources and leave our country militarily vulnerable to an attack.

PROJECTS WELL ALONG

Northrop's Advanced Design Department is active in several space projects—mostly classified. But the company has revealed the results of one project that describes basic design criteria for a manned space laboratory. The design has proved feasible in tests run on computers at the company's Computer and Datamation Center.

The proposed manned vehicle would be 7 ft in dia, 10 ft long and weigh a ton. It could be launched into orbit by contemporary rocket engines—an ICBM for the first two stages and Polaris for the third—and navigated by a star-tracking system similar to the one used in the Snark missile.

At launching, the pointed end of the capsule would lead to reduce drag and allow the passenger to take acceleration forces from front to back. In orbit, the capsule would make several revolutions until the ground tracking station established its exact posi-

Accommodations for an $80 million trip . . .

are practical, not plush. Here's capsule proposed by Northrop Aircraft as a vehicle concept for manned space flight. Cone houses 1000 lb of man and equipment, is 10 ft high.

tion. With position established, the navigation system would activate gas jets to turn the vehicle around so the blunt end faces foreward.

For the journey back to earth, reverse thrust rockets would be fired from a point 180° from the landing spot. The rockets would reduce capsule velocity so it would fall into an elliptical orbit whose perigee—lowest point—is the earth's surface.

REENTRY ITINERARY

The capsule would enter earth atmosphere at a shallow angle—about 2°—to keep heat and deceleration at acceptable levels. With its blunt end now foreward, the craft would be slowed by high drag: from 25,000 fps to 1000 fps by the time it reached 60,000 ft. A parachute released at 60,000 ft would assure a gentle landing. Without the chute, the craft would hit earth at 200 fps.

Are there any big problems? Yes, say Northrop engineers, but they are not insurmountable. Launching energies, though greater than now used, are within state-of-the-art capability. Guidance accuracy during boost is less than required for an ICBM. But on the return trip, velocity at the end of reverse thrust, direction of the thrust and its timing would have to be very exact.

Man's first space venture would necessarily be preceded by flights with instruments, then with animals as payload.

Tool Engineers Press for Reliability

PHILADELPHIA—The tool engineer has a critical responsibility as the creative coordinator of activity between management and the consumer. He is the one who translates ideas into tangible goods by prompt, effective and economical action.

This was the theme of the keynote address delivered at recent meeting here of the American Society of Tool Engineers by H. Hallowell, Jr., president of Standard Pressed Steel Co.

He pointed out that 100% performance imposes tough decisions on tool engineers who, as customers, must set the goals of machine tool designers. For example, components that are each 99.75% reliable will in a 100-component machine provide an overall reliability of only 76%, he said.

Hallowell offered five steps he considered contributive to greater reliability. They are: effective standardization, modular tool construction, raw materials that meet specifications, acceptance of new machining ideas, and utilization of the latest design equipment.

An important number of machine tool builders (some from abroad) offered digital and tape control equipment. Foreign machine tool exhibitors created a dramatic effect with their selling prices which were obviously low compared with domestic prices. Considerable attention was paid to improving methods for checking spread dimensions.

Several new precision measuring instruments and devices were shown for the first time, including a new B&S hand micrometer (*PE*—Mar. 31, p. 99), and a new measuring instrument, developed by Bausch & Lomb, with a 3-in. measuring range. Gaertner displayed an optical projector in which closed circuit TV provided a viewing screen which could be placed at convenience of the operator. This screen could also develop a bright image with greatly reduced lamp power.

Technical papers delivered during the conference showed increasing interest in machinery for automatic manufacture, and concern over the interrelation of product design and the design of tooling. Interest in automated machine tools ran high.

Whirlybird turbine . . .

Lineup of T-53 gas turbine engines being readied for delivery to the military by Lycoming Div., Avco Manufacturing Corp. This is first major production run of such engines for Army and Air Force copters.

Military Orders Gas Turbines (for Copters)

STRATFORD, CONN.—The first military contract for major production of a helicopter gas turbine engine has been announced by Lycoming Div., Avco Manufacturing Corp. The 825-shaft hp T53-L-1 engine is the nation's first gas turbine specifically designed for copters.

The joint Air Force-Army contract, which is expected to total approximately $10 million, calls for delivery of these engines starting next January. They are scheduled to power two helicopters, the Army Bell HU-1 Iroquois, a utility helicopter, and the Air Force H43B crash rescue copter.

EASY CONVERSION

The T53 has also been successfully flown in a twin-engine installation—the Vertol Model 105, a modified H-21 "Flying Banana."

In addition, the engine, developed with Army and Air Force money, is installed in three VTOL/STOL vehicles currently undergoing initial flight testing for Army evaluation by Vertol, Ryan and Doak aircraft companies. A new turboprop version of the T53 has been selected by the Army to power the Grumman AO-1 Mohawk observation aircraft.

Brussels Fair Still Setting Up Exhibits

BRUSSELS, BELGIUM—"Ten days after its opening, the 500-acre Brussels Fair is still a maze of partly finished buildings and exhibits," according to E. J. Tangerman, Editor of PRODUCT ENGINEERING, presently on a tour of several European countries.

He reports that many major setups are not complete and may not be for weeks—debugging of radical modern pavilion designs and exhibits is a slow process. However, the first major Fair in almost 20 years is already drawing daily throngs. This is basically a public Fair rather than an industrial one, so technical exhibits are in most cases incidental, and are included mainly to relate technology with people.

USSR Pavilion . . .

. . . is one of the largest at the Fair. The main floor (shown above) has at least six main stalls displaying working machine tools, and an area outside shows agricultural machinery. Machine tools shown include two with numerical controls, a Hydrotel-type miller (tape) and a 4-in. horizontal miller (card). There are also a transfer machine, an automatic copying lathe, and a vertical Multi-Au-Matic-type automatic. Other new machines notable in design are a grinder for spiral and helical cutters, a double hobber for spur and helical gears, optical rotary tables on a copy of a medium-size Pratt & Whitney or Hauser machine, and an optical vertical jig borer of the SIP Hydroptic 8 type. Workmanship appears good and design is plain and simple, in most cases showing lineal descent from European or American models.

US Pavilion . . .

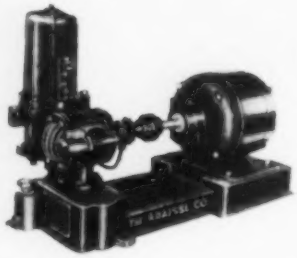
. . . one of the most successful at Brussels, is circular in design with outside trusses supporting a center ring by tension members. Other tension members from the ring top support the roof. The central area is a big pool with a ramp and float for fashion shows. Exhibits of typical Americana, ranging around the sides and on the gallery, are supplemented by projectors for color films. Pavilion also has a 1100-seat theatre which will present a series of major productions, plus atomic and geophysical displays, etc. Only item of machinery is an IBM computer. Emphasis is on American life rather than industry.

Major foreign pavilions . . .

. . . at the Fair include the French "butterfly" balanced by a boom, and those by the Soviet (upper left), US (upper right) and the Vatican (right). Note incomplete exhibits at left. French pavilion is still unfinished because the central pivot for the balance sank, requiring shoring of the building at outer corners, and one roof-edge truss was dropped during construction. France will show models of its newest commercial jets, as well as some rocket and vertical-lift experimental designs.

AIR POWER!

. . . Vacuum or pressure



There's a standard Kraissl air-pump for your direct motor drive or pulley drive applications—Patented force feed system of lubrication; radiant-cooled, fan cooled and water-cooled.

Capacity ranges from ½ to 170 cfm; pressure service to 50 psig and vacuum to 28 inches mercury.

Kraissl pumps have been serving industry since 1926— • Vacuum service • Air pressure • Hydraulic and machine tool applications • Circulating systems • Industrial fuel oil burner service • Strainers and filters

Write for bulletin A-1679 for Class 25 air pump shown or for literature on other models.

KRAISSL CO. Inc.

289 Williams Ave.,
Hackensack, N. J.

Automation for Electrolytic Stencil

CLEVELAND—An automated method for producing permanent electrolytic marks on metal parts in as short a time as 1.5 sec has been designed here by Lectroetch Co.

Integral to the development is a portable, 70-lb marking instrument that governs stroke timing of the motor-operated marker ram. Speed of marking depends on open area of stencil and type of metal.

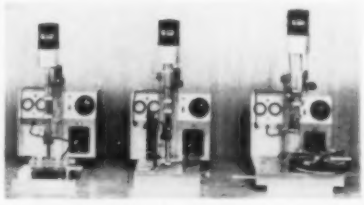
By means of the electrolytic process used—similar to plating—two kinds of marks are made: etched, which removes metal; and oxidized, which changes the color. Marks are made through open areas of a plastic stencil material to produce specific designs.

The machine is powered by a 115-v, reversible 1/20-hp capacitor motor which drives the vertical marking ram. Motor and shaft are held in an adjustable spindle sleeve so the entire mechanism can be raised or lowered to compensate for various heights of parts to be marked. Ram stroke can be set from ¼ in. to 4 in. as required.

Controls mounted on the main shaft include a miniaturized limit trip switch that reverses the motor to raise the shaft at end of each marking cycle; adjustable stroke limit collars that control length of stroke of the marking head mounted at end of shaft; spring loading pressure collar which can be pre-set to adjust amount of stencil pressure against the metal during flow of electrolyte and marking current.

Three interchangeable springs are provided so pressure can be varied from 1 oz. to 60 lb. Marking-stencil dwell (length of time on metal) is controlled by an automatic timer with a choice of setting from ¼ to 15 sec.

The basic instrument is provided in three models for use with different classifications of parts requiring special feeding methods. The first is Type HF, for hand feed with a completely automatic marking cycle. This unit uses a trip bar which actuates the marking head when the part is positioned. The machine completes one cycle and stops. Upon removal of the marked part, the timer resets and the unit is ready for another part. The HF model is designed for use with large parts requiring hand feed and maximum area stencils, such as hand and circular saw blades, knives, etc.



Ultrasonic Mark-up . . .
Displayed here are three models of Lectroetch Company's development of method to produce permanent electrolytic marks on metal parts in jig time—as fast as 1.5 sec. All three models are basically the same, being portable, weighing 70 lb and providing controlled stroking of the motor-operated marker ram.

Stencils employed in the electrolytic cartridges are of a nonclogging design said to afford more than 5,000 marks before signs of wear. Stencils are produced by the company with legends to customers' specifications.

Improvements in electrolyte fluids and stencil materials enable customers to reproduce both fine-line and heavy broadline copy, as well as reverse white on black marks such as trademark designs.

Africans Offer Electronic Yardstick for Mileage

FORT BELVOIR, VA.—A lightweight electronic device to measure distance is being tested at the Engineer Research and Development labs here.

Distances up to 40 mi are calculated by the instrument. It consists of a sending and receiving station located at either end of the space to be measured. In operation, the master station at one end of the line sends a microwave signal to the slave station at the other end. The signal is then reflected to the master station where travel time and distance are calculated.

Equipment weighs 90 lb and can be carried by two men. Measurements are made in ⅟₁₀th the time required by conventional apparatus and require fewer personnel. The device, called a tellurometer, was developed by the Telcommunications Research Laboratory of the South African Council for Scientific and Industrial Research.

Pop! . . .

. . . and a heavy concrete and steel dummy missile simulating the Navy's Polaris ballistic missile is ejected from a prototype launcher at the San Francisco Naval Shipyard, Hunters Point, Calif. Called Operation Pea Shooter, the launcher has been throwing recoverable dummy missiles into the bay many times a week. The underwater launching of the Polaris —dubbed Operation Pop-Up—a solid-fueled, 30-ft-long, 5-ft-dia IREA is expected to become operational by 1960. Nuclear subs to accommodate the missile are now being built. Speculation on the propulsive mechanism for the dummy missile leads to steam, since a nuclear powered sub will have sufficient quantities of this medium to launch the real missile. Westinghouse Electric, in charge of the launching device, and Lockheed Missiles System Div., missile system manager, are collaborators on the project

New High Temp. Alloy

PITTSBURGH—Nicotung, a new alloy still in the development stages at Westinghouse Electric Corp., is slated for jet engine turbine blade material in the 1800 F range. The company says the metal has good castability, oxidation resistance, stress rupture strength and ductility. It is basically a nickel-chromium-tungsten alloy, plus five additional elements.

At 1700 F, the metal reportedly will take a stress of 32,000 psi for 100 hours without failure; and at 1800 F, a stress of 22,000 psi for 100 hours.

Solar Heating May Brighten 'Dark Continent'

JOHANNESBURG — Experiments now being carried out by the South African Council for Scientific and Industrial Research promise success in building cheap solar hot-water systems for private homes.

Research, being carried out in the Council's laboratories near Pretoria, may result in more economic exploitation of the sun's energy than is possible at present. This will offer many advantages to dwellers in the rural and semi-urban areas of the Union and other countries where electric power is either non-existent or distributed on a high tariff. Even now, in those parts of the Union where costs of electricity to the domestic consumer are high, solar energy can compete for cost.

The solar heating unit erected on the roofs of houses is of simple design. It consists mainly of an insulated absorber plate with a series of pipes through which the water flows. The unit is exposed to the sun through a glass cover.

The C.S.I.R. is also making experiments directed towards harnessing solar energy for economical distillation of water. One idea is to provide distillers for farmers in remote areas to get pure domestic water from brackish water.

So far science has only been able to use solar energy economically where water temperatures of less than boiling point have been sufficient. Although much more energy could be obtained from the sun than from nuclear sources, the cost of concentrating this dilute form of energy has been the obstacle blocking its full exploitation.

Aircraft Firm Expands into Nuclear Heating

MARIETTA, GA.—Lockheed Aircraft Corp. has formed a separate operating branch to design and manufacture nuclear reactors for generation of industrial heat. The process heat reactors are expected to be competitive with systems using gas, coal or oil. The division will also manufacture research and training reactors for universities and small portable power packages.

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products cost no more today than they did ten years ago

Some even cost less.
Yet without exception,
they're *better* products now:
. . . stronger pound for pound than steel
. . . impact resistant, tough
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Beautiful, translucent lamp shades

Strong, lightweight business machine housings

Rust and corrosion-resistant planters

Continuing research at the Molded Fiber Glass Research Laboratory is the reason why, in the face of constantly rising costs, MOLDED FIBER GLASS products are continuing to improve, and continuing to hold the price line.

Shouldn't you investigate custom molding by MOLDED FIBER GLASS?

Molded Fiber Glass Company

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Certain component parts of "Explorer", the first American satellite, required gold plating. Logical choice was Technic 24 karat INDUSTRIAL GOLD — the first and purest soluble 24 karat gold in the world. Or out of it!

UNIQUE PROPERTIES SOLVE UNIQUE PROBLEMS

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If you have requirements for electroplated gold, other precious metals, or alloys — consult Technic. We equip you with controlled electroplating apparatus and/or solutions that eliminate variables, assure precise performance reproducible as often as required. Find out how Technic Service assures quality with economy.

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THE LARGEST ENTERPRISE OF ITS KIND IN THE WORLD

IC Engine has Space Potential, Missile Engineer Says

Los Angeles—Dr. Donald Mackay of North American Aviation's Missile Development Div., believes an analysis of all possible auxiliary power sources—considering such factors as the weight of the basic unit, and the weight of the fuel and the containers required to hold the fuel under high-vacuum conditions, indicate that the internal combustion engine has space potential.

Dr. Mackay was one of the speakers in a discussion of "On-board Energy for Satellite Vehicles—Source—Conversion and Use," sponsored by the Southern California section of SAE.

Dr. G. C. Sziklai, asst. to the vice pres. of engineering at Westinghouse, Pittsburgh, another speaker at the meeting, said that the most practical approach to space vehicle communications would be to rely on big receiver installations on earth with a query-feedback system to repeat information until error-free transmission had been accomplished, thus minimizing the size and power requirements for the on-board transmitter.

Navigation, he felt, might be simplified by orbitting a number of radio-reflector satellites around the earth. With these in known orbits, the space ship could get an accurate "fix" by reflected radio signals.

Another scheme that would help to keep the ship on a known straight-line course would be a light-transmitter located in the polar region, using multicolor lights whose combined wavelength would be constant only as long as the ship was travelling along a line passing through the center of the transmitter. Dr. Sziklai said that steering equipment should be designed so that it will change the direction in which the ship moves rather than change its attitude.

H. A. Evans, mgr. of weapon system advanced design for North American, said that the X-15 will obtain orbital speeds and could be used as a ferry to a space platform.

Computor Market Aims at Engineers

Detroit—Engineers hunting for help in solving problems are becoming aware of the talent in computing machines—so much so that they are expected to boost computer sales by a factor of 10 each year. Such was the prediction made here at the first annual Conference on Automatic Techniques.

It was pointed out that design engineers can achieve enormous economies with aid from computers. The designer feeds a number of possibilities into the machine and chooses the solution that indicates how to do the job cheapest.

Both analog and digital computers have suitable applications, the conferees were told. With the digital type the designer must solve his problem repeatedly, each time choosing a different set of variables. But because so many of the items he must include in his product are commercially standardized, the number of design alternatives has a practical limit.

Where an infinite number of solutions is possible, the analog computer often has advantages. Changes in variables are obtained by turning knobs, and the effect on design is observed immediately on an oscilloscope.

Electronics Reduces Teleprinter Errors

London—An electronic code checking system called Autoplex has been introduced by Marconi's Wireless Telegraph Co. of Chelmsford for twin teleprinter channels operating on normal 50 or 45.5 band start/stop circuits in time division multiplex.

The fully automatic equipment incorporates storage for a variable number of characters to give immediate repetition of any character distorted during transmission.

The standard 5-unit input code is converted to a 7-unit, 3-mark code

(Continued on page 28)

Naugatuck PARACRIL OZO

THE NEW OIL- AND OZONE-RESISTANT NITRILE RUBBER

Naugatuck's challenger for leadership in the field of ozone-resistant, oil-resistant rubber

Compared to the present leading competitive general-purpose oil-resistant, ozone-resistant rubber, Paracril® OZO vulcanizates show *marked superiority* in resistance to oil, fuel and weathering (ozone) and in color retention, abrasion resistance and low moisture absorption. In tensile strength, flame resistance and cost of complete compound, both are essentially the same.

Thus Paracril OZO provides a unique combination of properties far in excess of ordinary nitrile rubber!

But Paracril OZO is no ordinary nitrile rubber! It is a modified Paracril which incorporates the compounding discoveries of Naugatuck research chemists to which reference has been made in recent Paracril advertisements. The chief modifier is one of Naugatuck's Marvinol® vinyl resins, and the product includes excellent stabilizers for both vinyl and rubber.

Paracril OZO is supplied in the form of small, light-colored flakes, permitting easy handling and considerable flexibility in processing methods.

A most important feature of Paracril OZO is that the vinyl resin in it is completely fluxed during its manufacture. This not only eliminates a difficult compounding procedure on the part of the user but also assures full development of the added properties imparted by the vinyl modifier.

Its unique properties particularly recommend Paracril OZO for wire jackets, shoe soles, coated fabrics, automotive parts, hose and belting jackets. Write for Bulletin No. 219 which contains compounding suggestions and interesting test data on Paracril OZO vulcanizates.

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Division of United States Rubber Company

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Here's the **NEW** variable-speed, explosion-proof Model 16AM

GAST rotary vane AIR MOTOR

Newest and largest Air Motor in the Gast line, this Model 16AM may solve an original equipment (or plant use) problem for you! It's compact — only 14⅜" x 8" x 7⅝" high. It's light in weight — only 65 pounds. It delivers up to 7 h.p. with good torque characteristics.

Listing at $200, it offers unique advantages for driving equipment located near a compressed air source:

1. Speed infinitely variable from 300 to 2,000 r.p.m. with any simple air valve control. Air motors always run cool.
2. Explosion-proof design, safe in explosive atmospheres.
3. Can't burn out from overloads — stalling doesn't harm it.
4. Heavy-duty construction with ball bearings, dual seals.
5. Six vanes in rotor automatically take up their own wear for constant high efficiency and long life.

Designed to operate on air pressures from 30 to 90 p.s.i., Model 16AM is suitable for driving direct, through gear box or pulley. Foot (base) is standard. End plate also has four tapped holes for flange mounting to gear box or other driven unit.

Perhaps you can use air power on a hoist, fan, pump, mixer or other product. Write today for new Bulletin 16AM.

GAST MANUFACTURING CORP., P.O. Box 117-V, Benton Harbor, Michigan

SEE CATALOG IN SWEET'S PRODUCT DESIGN FILE & A.S.M.E. CATALOG

GAST ROTARY

- AIR MOTORS TO 7 H.P.
- COMPRESSORS TO 30 P.S.I.
- VACUUM PUMPS TO 28 IN.

"Air may be your answer!"

(Continued from page 26)

before transmission. Arrival of a distorted character at the receiving end gives a wrong "mark" count. This initiates the transmission on the return path of a "repeat" signal.

The "repeat" signal when received at the transmitting end interrupts the intake of new information and causes re-transmission of the characters held in storage circuits. The number of elements held in store is normally three to four but is dependent on the total "go-and-return" propagation time, which can be up to 450 millisec.

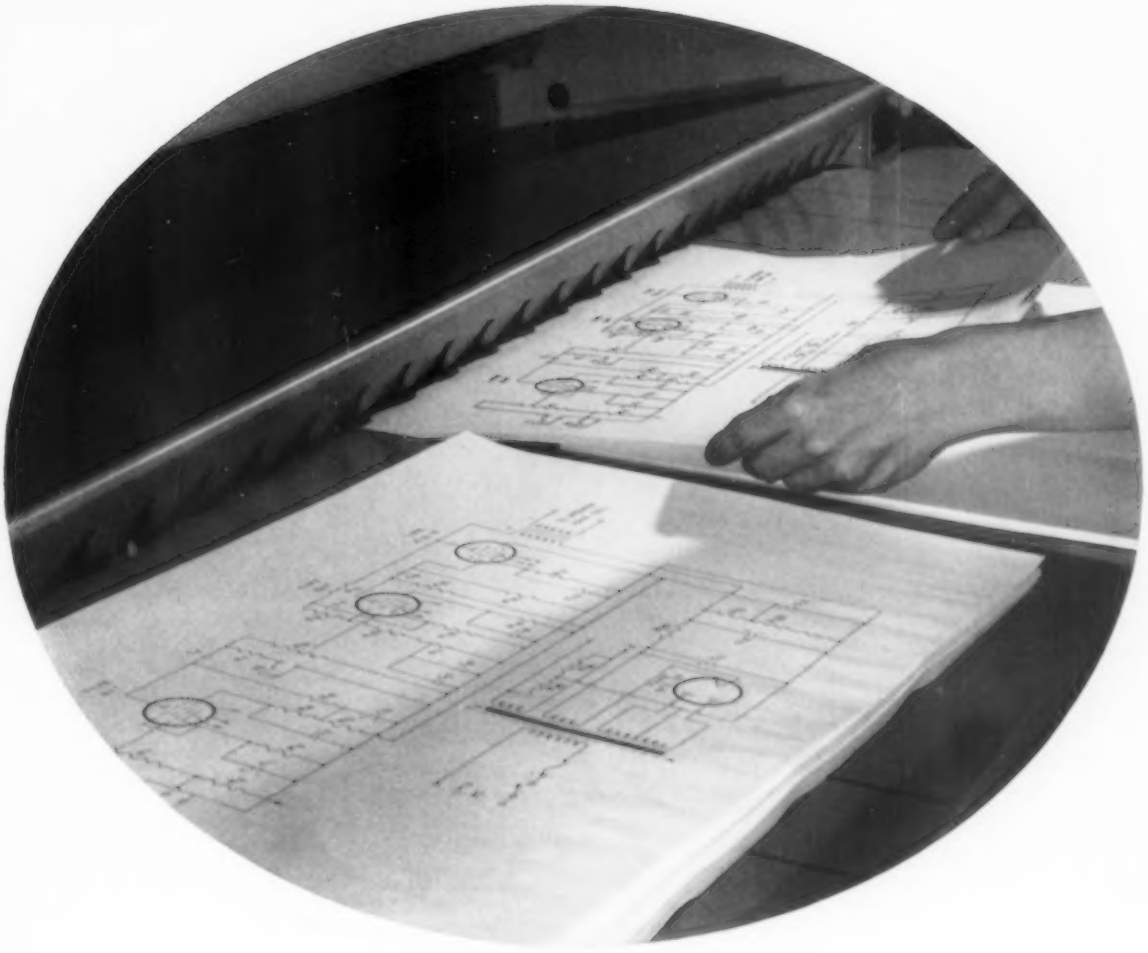
Now Hear This: US Education Superior to European

NEW YORK—A torrent of words has been written about the US public education system in recent months—many of them proclaiming superiority of the European system. But, says Byron S. Hollinshead, former president of Coe College, who recently returned from a five-year stint with the Technical Assistance Department of UNESCO in Paris, Europeans feel "intense dissatisfaction" with their own system.

Writing in the *Education Record* of the American Council on Education, Hollinshead says Europeans told him: "Your system gives a chance to everybody. How can you afford to educate so many? How do you make Americans out of Europeans so quickly? National feelings are very strong here in Europe but emigrants to the US settle down quickly and peacefully with former enemies."

So, to improve our educational system, we should not pattern on the European model, says Hollinshead. He goes on: "What then is the American, this new man who has made the deserts bloom, taken the peasantry out of farming, has removed the drudgery from factories, whose productivity per worker is by far the highest there is, who is surrounded by the world's best existing systems of communications and transportation? Was this program made by a people with an inferior education system? If so, inferior to what? To their own ideals perhaps, but to little else."

Hollinshead adds that at the end of their 16th year, 70% of Americans are still in school, contrasted with 10% in England and France.



Cronaflex is durable:

TRADEMARK

Same "second original" makes hundreds of exact copies

The CRONAFLEX "second original" in the picture has already reproduced over a hundred clear, black-line copies. It's good for hundreds more. CRONAFLEX shrugs off kinks and wrinkles, no matter how many times it's passed through a reproduction machine.

The CRONAFLEX matte surface provides the finest pencil and ink acceptance. Lines never smudge. They can be drawn—or erased and redrawn—on either side of the film. You make your corrections right on the CRONAFLEX; your valuable original drawing remains untouched.

CRONAFLEX Engineering Reproduction Films are available in three types: (1) Direct Positive Film, (2) Contact Film and (3) Projection Film. For more information on this revolutionary new line, write: E. I. du Pont de Nemours & Co. (Inc.), Photo Products Department, Wilmington 98, Delaware. In Canada: Du Pont Company of Canada (1956) Limited, Toronto.

This advertisement was prepared exclusively by Phototypography

DU PONT

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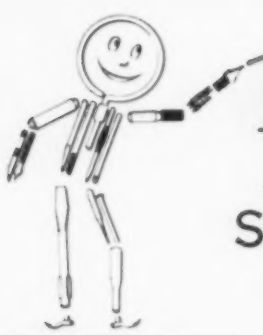
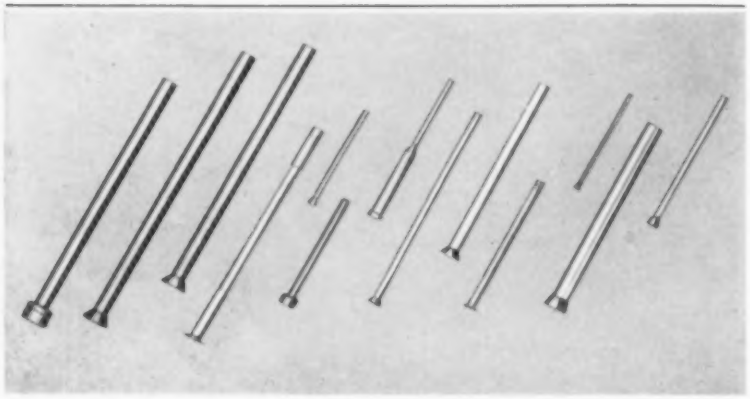
Better Things for Better Living . . . *through Chemistry*



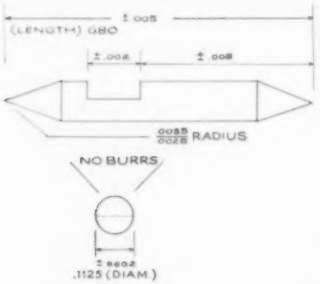
NEWS
from Torrington on
SMALL PRECISION METAL PARTS



Here at Torrington, our "Specialties" machines are constantly at work producing an endless variety of custom-built small precision metal parts. Our engineers help design many of these parts, at the same time developing the most efficient production methods to solve our customers' problems.

For example, one manufacturer recently needed perforating punches with an upset head (see photo above). His own facilities were inadequate for the job . . . specifications called for close body tolerance, grinding, precision heading, hardening and annealing. The punches were to be made from tool steel and produced without flash to allow proper seating. Torrington engineering and production facilities solved his problem.

Another—the volume production of timer parts with low cost a critical factor.



For this job, Torrington developed special high-speed equipment to provide automatic end turning and cross milling in a single operation. The result—a high-quality part produced at low unit cost.

Whatever the part, varying degrees of strength, ductility, hardness, toughness, magnetic or nonmagnetic properties are required to give it the exact qualities needed for its particular function. In Torrington's modern laboratories, highly

experienced metallurgists and engineers are employed to insure that each precision metal part is produced by the most efficient process and to the highest standards required for its application. They'll be glad to help you on all metallurgical problems.

If you have problems involving custom-built small precision metal parts in large quantities, write direct to

The Torrington Company, Specialties Division, 230 Field Street, Torrington, Conn.

TORRINGTON SPECIAL METAL PARTS

Makers of Torrington Needle Bearings

Bits and Pieces

Autonetics Div. of North American Aviation says that a transistorized computer capable of approaching man's 100 watt brain would require a 100,000,000 watt power supply. . . . W. H. Byrne has announced that a total of $3,079,200 has already been contributed from industry and the five founder engineering societies towards the new $10 million United Engineering Center in New York. A campaign among the Founder and Associate societies to raise $3 million will appeal to all members this year. A campaign to raise $5 million from industry is now under way. . . .

Problems of a small shop operator as stated in the Gray Iron News: "A couple of years ago we granted a 7th paid holiday. This was Pheasant Day. The contract didn't really call it that. It stated: 'In addition to the holidays named in article XII, Section 2, Armistice Day shall also be a paid holiday except that in the event that the pheasant season shall open on any other day than Armistice Day, then such other day shall be a paid holiday in lieu of Armistice Day'."

A mine detector weighing 7-lb—about one-fourth as much as current standard models—has been developed by the Army's R&D labs at Fort Belvoir. Capable of locating mines with metal components, the detector is equipped with transistors; maintenance has been simplified so that operator can perform major repairs. . . . Ohio State Univ and Univ of Wisconsin were named by the IGY Committee as data process centers for scientists returning from the Antarctic. At Ohio State scientists will analyze data gleaned from studies of glaciology, solar radiation, micrometeorology, ice shelf deformations and ice cores. The Wisconsin group will work in fields of seismology and gravity. . . . An aluminized suit that will allow a man to stand within two ft of a forest fire for two or three minutes without discomfort has been tested successfully in northern California forests by the US army. The suit is made of aluminized kraft paper treated with flame retardant. Suit consists of parka, hood, face mask, leg sleeves and mittens.

(Advertisement)

Facts to consider when you're buying

Chromate Conversion Coatings

for Corrosion Protection, Paint Base, Decorative Finishing

WHAT IS IRIDITE®?

Briefly, Iridite is the tradename for a specialized line of chromate conversion finishes. They are generally applied by dip, some by brush or spray, at or near room temperature, with automatic equipment or manual finishing facilities. During application, a chemical reaction occurs that produces a thin (.00002″ max.) gel-like, complex chromate film of a nonporous nature on the surface of the metal. This film is an integral part of the metal itself, thus cannot flake, chip or peel. No special equipment, exhaust systems or specially trained personnel are required.

If your company is manufacturing or buying parts or complete assemblies made from or plated with any of the more common non-ferrous metals—zinc, cadmium, aluminum, magnesium, silver, copper, brass or bronze—you've probably already run up against the question of finishing these surfaces with a chromate conversion coating. These coatings are used to protect against corrosion, or to provide a base for paint or to provide a decorative finish for sales appeal or shelf life. Since chromate conversion coatings represent a relatively new means of obtaining these finishes, this digest of facts to consider may be of value to you.

1. THE COATINGS THEMSELVES. There are many brands on the market. All are similar in many ways. Each, of course, offers its own specific advantages and these may relate to operating techniques, performance under actual use conditions, cost, availability, etc. Naturally, you'll want to choose a coating that is widely known and accepted under both military and civilian specifications.

2. THE COMPANY BEHIND THE PRODUCT. Is it a reliable, established organization? Does it offer experienced technical service, both from the field-engineering organization as well as the home office and laboratories? The man who sells and services your installation should be thoroughly familiar with not only chromate conversion coatings and their applications, but also with the characteristics and performance of related finishing operations such as precleaning, electroplating, painting, etc. This is most important since all steps of the finishing cycle must be functioning properly for the satisfactory performance of the ultimate finish produced.

3. AVAILABILITY OF THE PRODUCT. Ideally, of course, the material should be readily available to you from nearby warehouses to avoid time loss in long distance shipping and to provide emergency service, should the need arise.

4. COST. Naturally, the initial price of the material is important to you. However, just as you consider ultimate cost when you are buying mechanical equipment, ultimate cost must be considered for these finishing chemicals. So, it will pay you to investigate consumption costs, labor costs and the other factors which go into the determination of ultimate cost. Further, cost alone gives no indication of product performance, so careful attention must be given to the purpose the finish must serve and the value that finish will add to your product.

5. FACILITIES FOR RESEARCH AND DEVELOPMENT. Perhaps the existing types of chromate conversion coatings do not include a compound that will accomplish exactly what you wish. Then, it is important to deal with a supplier who has adequate research and development facilities available to work with you to produce a material to meet your needs. Naturally, such a project is seldom completed overnight. But, with complete cooperation and confidence from both you and your supplier, chances are a satisfactory program can be completed.

These are the concepts of sales and service on which we, Allied Research Products, Incorporated, have developed and marketed the line of Iridite chromate conversion coatings . . . superior product performance, complete sales and technical service, easy product availability, economical cost, extensive research and development facilities. No doubt you are familiar with our line and have seen this trademark—

IRIDITE®

—in our advertising, technical literature or on shipping containers in your plant. Remember this trademark when you're buying or investigating chromate conversion coatings for your company. It's your assurance of quality, economical products from a reliable and established company, skilled sales and technical service from both our home office and a national network of representatives, immediate availability from warehouses in strategic industrial areas and our willingness to work with you to develop new finishes to meet your needs, should the present line fall short.

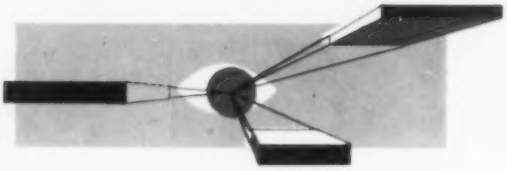
For complete information on Iridite chromate conversion coatings, write today for your free copy of our technical data file. Or, for immediate advice, call in your Allied Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.

Allied Research Products, Inc.

4004-06 EAST MONUMENT STREET

BALTIMORE 5, MARYLAND

***Manufacturers of* IRIDITE®, IRILAC™, ARP® Brighteners and Plating Chemicals — West Coast Licensee: L. H. Butcher Co.**



POINTS

THE QUESTION:

Should Congressional Committees Hire Staff Engineers to Assist in Research and Development Evaluation?

SEN. WILLIAM F. KNOWLAND
Committee on Appropriations

"Proposed legislation . . .

often involves complex and technical questions. No matter how much the individual member may desire, it is impossible for him always to be sufficiently knowledgeable to render authoritative judgment on the many technological aspects of certain matters brought to him for decision.

"Congress long has been aware of the need for such experts' aid in forwarding the legislative process. The legislative Reorganization Act of 1946 provides: 'Each standing Committee of the Senate and the House of Representatives . . . is authorized to appoint by a majority vote of the Committee not more than four professional staff members in addition to the clerical staffs on a permanent basis without regard to political affiliations and solely on the basis of fitness to perform the duties of the office. . .'

"It is in Committee hearings that proposed legislation must finally be exposed and examined for faulty structure. It is the duty of Committee staffs to produce the background and technical information required for clear appraisal of involved questions.

"The only way this can be accomplished is for Committees of the House and Senate to receive the assistance of experts–men who are highly trained, professional individuals, capable of understanding and explaining the extremely complex and technical problems which sometimes confront members of Congress. In certain cases, experience has shown that this vital need can best be met by appointing to Congressional Committee staffs men who are thoroughly trained in the fields of science and engineering."

"The basic point . . .

is to realize that Congressional work differs markedly from that performed in the Executive Agency. A Congressional committee can be concerned with matters of engineering today, of law tomorrow, and of commerce the following day. To a great extent, we must go from subject to subject with far less continuity than pertains to the Cabinet posts.

"A Congressional committee involved in problems of engineering must, of course, have ready access to someone familiar with the problems. This same thing is true of a committee involved in problems of physics and chemistry or aeronautics. During the recent inquiry into the satellite and missile programs we had the services of two eminent scientists on a temporary consultant basis. They were experts in certain specific fields in which we were interested. If and when we go into other phases, however, we would probably have to call upon men of different skills.

"Fundamentally the problem is a practical one which must be handled on a day-by-day basis with the only criteria consisting of that method which best assures the availability of the best possible sources of information."

SEN. LYNDON B. JOHNSON
Majority Leader, Senate

OF VIEW

"I would say yes . . .

Congressional Committees need better staff advisors. This sort of thing could be overdone, but at present the staffs of most Committees are inadequate; particularly in the scientific and engineering field."

REP. GEORGE MAHON
Committee on Appropriations

W. H. MARTIN
Director of Research and Development
Department of the Army

"The effectiveness of evaluation . . .

obviously must depend upon the competence of the people who engage in it. Research and development programs of the military departments are subject to close scrutiny by the Department of Defense and by their advisory panels of experts drawn from industry and universities.

"I strongly believe, myself, that in the last analysis the goodness of a research and development program, and this is particularly true of the research phase, depends to a large extent upon the competence of the managers of the program and their associates, and that much reliance must be placed on the competence of these people.

"At the present time, in the military department, Defense, Congress, Bureau of the Budget, the press and various other organizations, there is no dearth of people who are scrutinizing and attempting to evaluate the R & D military programs. While there should be an understanding of the general import of such programs by each of these agencies, I look with some concern on the growing concatenation of appraisers and evaluators. In the last analysis, it comes down to the important question as to who is going to evaluate the various evaluators.

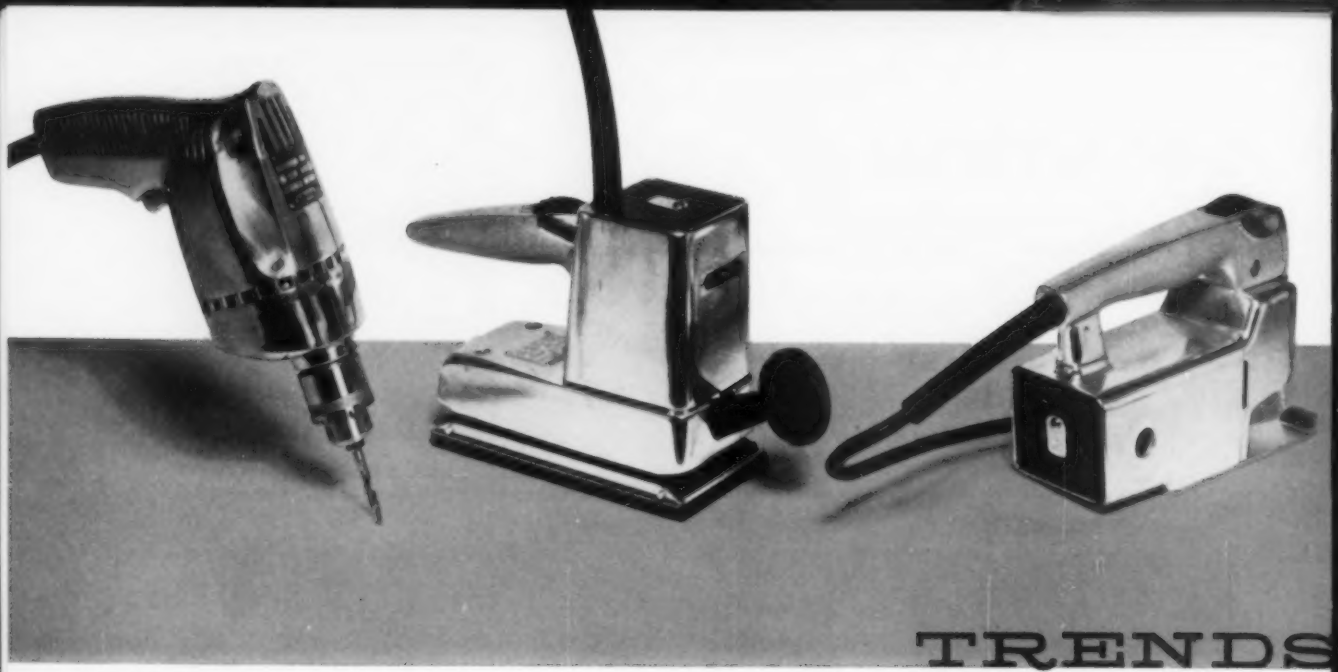
"One of our big difficulties is that the increasing number of independent appraisals and evaluations of these R & D programs, with the attendant series of approvals that have to be obtained, tends to increase the time required to get the job done. Reducing the development cycle for military weapons is today one of our key problems."

"Such a procedure is impracticable . . .

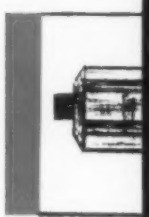
The engineering elements of modern armament, whether in planes, fire control systems, missiles or what have you, are extremely complicated and extremely specialized. We could not conceivably hire engineers sufficient in number or competent enough in these specialties to get useful service out of them.

"My personal solution to this problem is to visit the centers of design and production and, being an engineer myself, obtain a general over-all view of the problems by consulting with the responsible engineers on the spot. This is a satisfactory solution for me, but it is not so applicable to non-engineering Senators. However, I feel that it is better for them to have direct access to the experts than it is to pick out particular engineers through whom to strain the information. They could not be sure that these engineers will not have their own prejudices and points of view."

SEN. RALPH E. FLANDERS
Committee on Armed Services



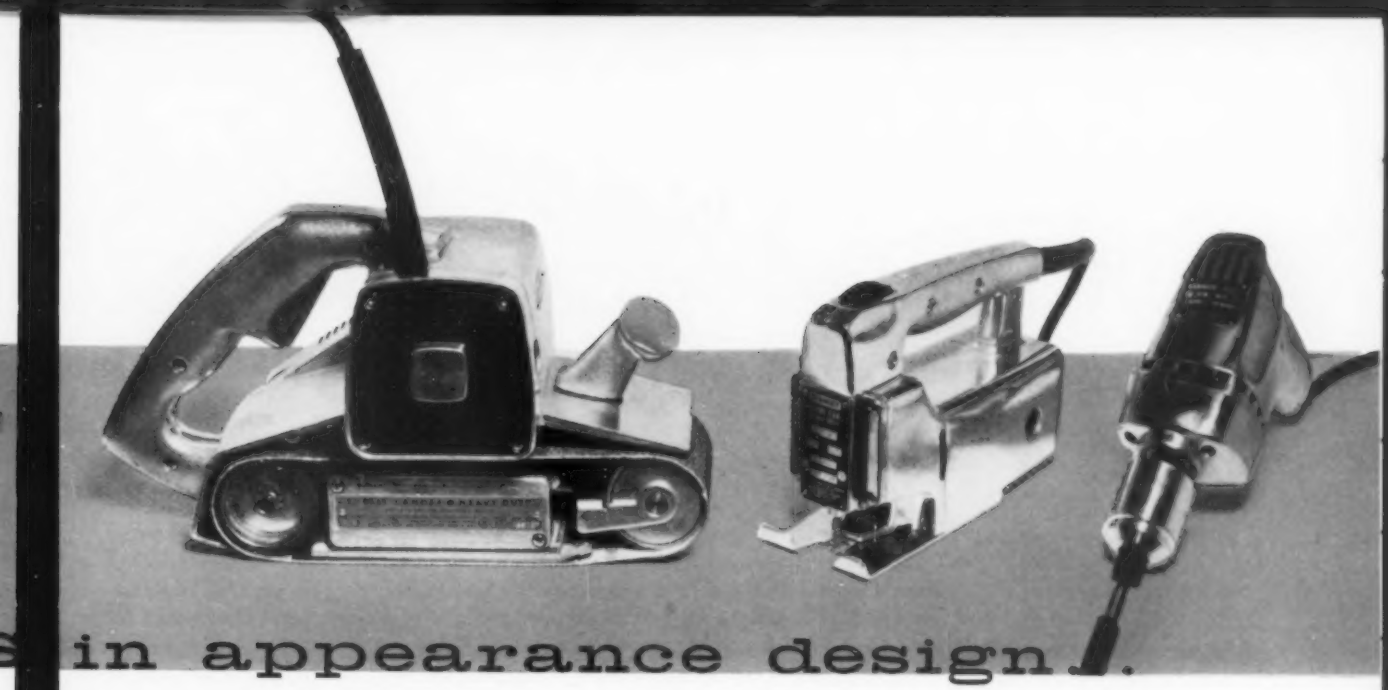
Same housing is used throughout series of ¼ and ⅜-in. drills and drivers making up latest addition to new family of power tools shown above.



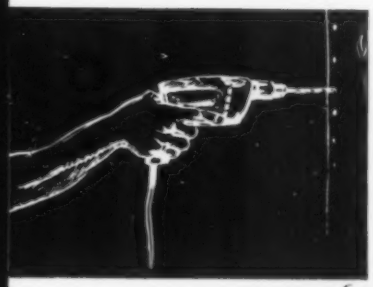
Driver replaces

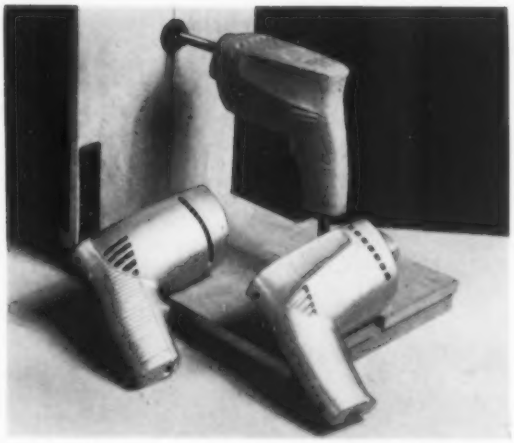
Handling ease, balance and rugged appearance were basic requirements specified for line of power tools shown across top of page. Appearance was achieved by using angular shapes and rectangular forms to give a feeling of solidness and power. Balance resulted from reverting to organic forms for multiposition handles and grips with nonslip surfaces. Handling ease came from reducing distance—from center of gravity to tool grip—to a minimum and placement and stiffening of power cord to keep it away from work area.

Management realized that having a good product is not enough. The product must be attractive—for maximum sales appeal. In highly competitive power tool market it is necessary to "make the consumer reach for it." Here is where the value of the industrial designer is recognized—to assure the kind of customer appeal required for successful competition—but his work must not interfere with primary function of the product. Of course, the industrial designer often augmented user satisfaction through human engineering.

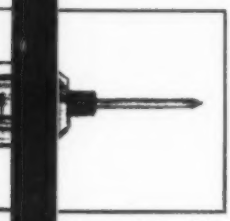


in appearance design...





Clay models give designer a chance to check successive developmental stages in three dimensions.



uck on 3/8-in. drill.

The industrial designer contributed to entire development, working out desired objectives with management and engineering. One main objective was to produce several tools easily identified by family resemblance or corporate look. . .

Participating as a consultant, the industrial designer, working with the engineering department, engaged in much give-and-take to achieve best results. Function was an engineering responsibility; appearance, the designer's job. Suggestions and ideas were fed to management and their opinions sought. Management opinions frequently influenced development program.

Electric drill and power driver (opposite page) are latest addition to this new line of power tools, conceived and designed over an extended period of time as a product family. Rectangular body shape with flat top surface emphasizes resemblance to tools preceeding it. Concave finger-rest on each side of motor housing provides excellent gripping surface and reduces bulk of body shape. With thumb and forefinger in concave finger rest that runs around rear of motor housing, operator's push or weight is directly in line with tool bit and his third or fourth finger can operate switch. Crenelated vents and longer handle add to rugged look.

Drill is made in both 1/4- and 3/8-in. sizes. By interchanging chucks, 3/8-in. drill shown may be converted into driver for woodscrews, lag screws, self-tapping screws, machine screws and nuts. Entire line designed by Laird Covey, Monroe, Conn., for Stanley Electric Tools, Div. of Stanley Works, New Britain, Conn.

ELECTRONIC and ULTRASONIC quality control of MUELLER rod, tube, fabricated parts and

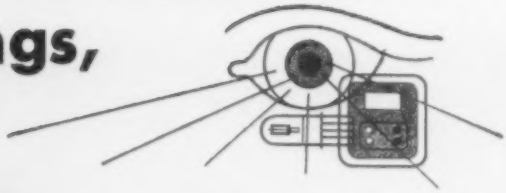
Every practical electro-mechanical testing device available to industry today is used by the Mueller Brass Co. to maintain Positive Quality Control during each manufacturing operation. From the first stages of alloying, spectroscopic analysis is used to maintain exact alloy composition so that they are precisely as specified. Ultrasonic test equipment is utilized in the non-destructive testing of extruded brass and bronze rod, copper tube, forgings and fabricated parts. In machining and finishing operations, statistical quality control is employed to eliminate the effect of possible human error. These quality controls are all designed for one purpose . . . to give you complete "product protection."

•

Copper base alloy rod is examined by a trained operator with the aid of an ultrasonic reflectoscope. Through electronic circuitry, ultrasonic echoes are translated on a cathode ray tube. Any internal flaws are readily apparent. Both rod and tube are tested by this method, which is just one of many Positive Quality Control checks used by the Mueller Brass Co.

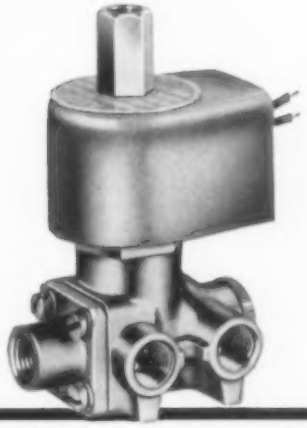
Through ultrasonics, the immerscope (Left) locates internal defects, and has exceptional versatility for examining intricately shaped parts, such as the forging being checked in this photo. When testing, a transducer, located at the bottom end of the search tube, is electronically actuated to produce from 2.2 to 25 million cycles per second. Ultrasonic echoes are reflected back to the transducer from the material, indicating any defects that may be present. Limits may be pre-established and the sound findings are visually recorded on the cathode tube. This is another instance of Positive Quality Control in action.

TESTING helps insure positive BRASS CO. forgings, assemblies . . .



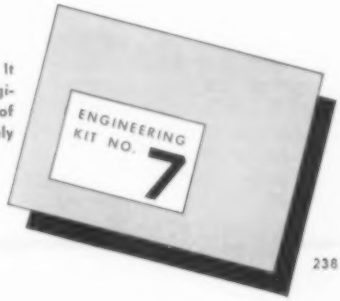
The direct reading spectrometer (Left) makes it possible to accurately analyze an alloy for chemical composition within 90 seconds while the metal is in the molten stage. A sample specimen is poured, cooled and sent to the laboratory, where it is placed in the spectrometer. Through the diffraction gratings in the machine, the "spectrum" analysis of the alloy records its exact chemical composition. With this equipment, alloy specifications are matched exactly, thus insuring a better finished product through Positive Quality Control.

THIS MIDGET 4-WAY SOLENOID VALVE (Right) is one of a complete line designed and manufactured by the Automatic Switch Co. of Florham Park, New Jersey, and is used for operating valves, dampers, and many types of automatically controlled equipment. One of the most important components in these valves is the non-porous brass body forged by the Mueller Brass Co. who also perform all the major machining operations so that the body is ready for use upon delivery. The forged brass body insures freedom from porosity and reduces possibility of corrosion. The Mueller Brass Co. Positive Quality Control program insures ASCO complete "product protection" . . . and eliminates chance of "in-service" failures.



THIS LARGE 18" FORGED GEAR, along with two others of the same type, is used in a steam turbine installed in a power generation facility of the Wisconsin Electric Power Company, at Port Washington, Wisconsin. The gear was forged in open dies by the Mueller Brass Co. from tough, long-wearing 603 alloy. The gear operates at 25-30 RPM and is turned by the turbine, which has a capacity of 80,000 kilowatts. Strength and dependability are of utmost importance in applications like this, and in such cases Positive Quality Control insures peak performance.

Write for your engineering kit no. 7. It contains complete laboratory and engineering data plus typical examples of Mueller Brass Co. products used in widely diversified applications.



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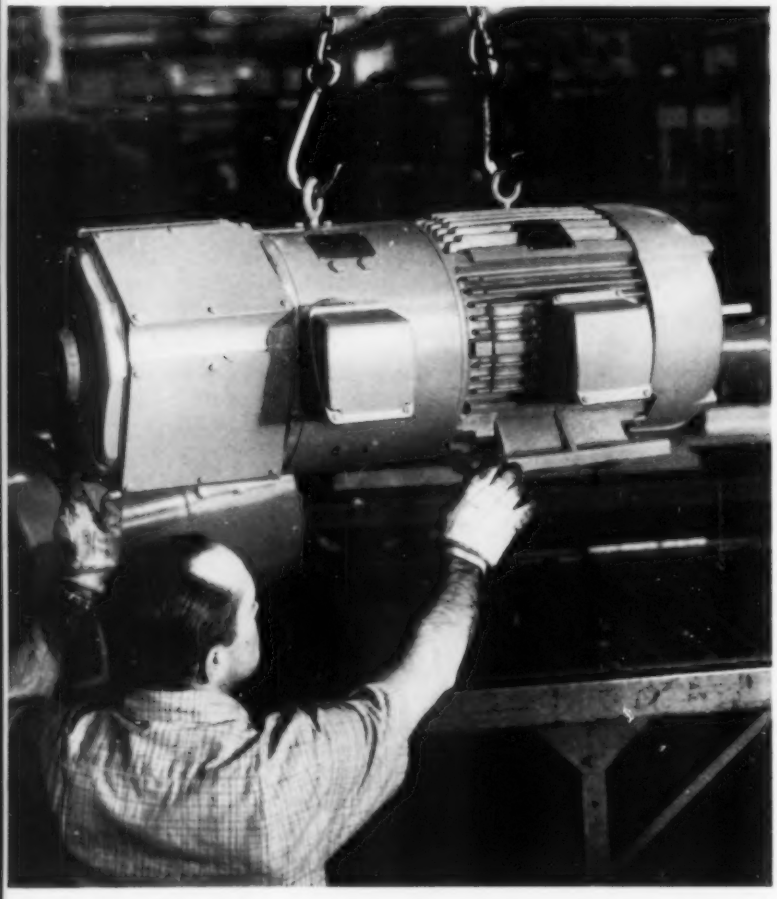
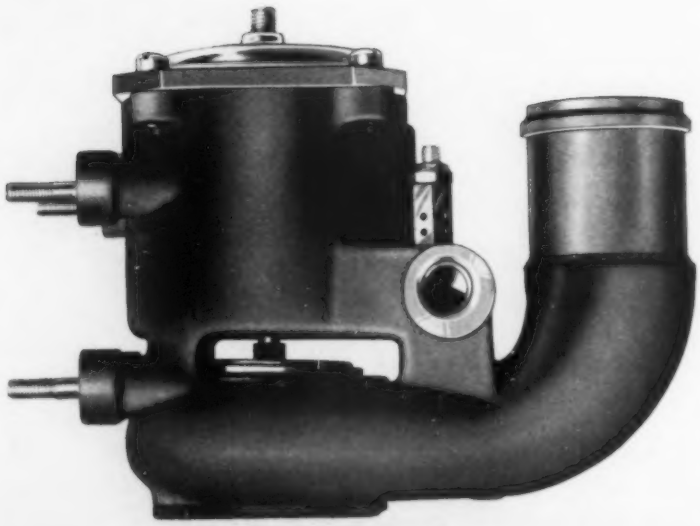
MUELLER BRASS CO. PORT HURON 22, MICHIGAN



Adjustable speed drive . . .

package integrates an ac motor, a dc motor and semiconductor rectifiers. Continuously variable speed control over 2:1 speed range is possible. Max speed is 1690 rpm. Power requirements can be supplied by normal ac distribution systems. Presently available in ratings 10 to 50 hp to serve constant-torque or constant-hp applications. Basically, drives consist of a wound-rotor motor and a dc motor built on a common output shaft. Semiconductor rectifiers rectify slip power from wound rotor to supply direct current to dc motor armature. Moving parts are limited to those found in wound-rotor motors. A second set of rectifiers convert ac line voltage to dc to energize shunt field of dc motor. Speed control can be obtained by varying setting of a rheostat in shunt field circuit; system permits electronic and magnetic amplifier equipment for field control. With full line voltage applied, max starting torque is 600% of full load torque. Drives demonstrate speed regulation of 7.5% over the full speed range. Full load efficiency over entire speed range is not less than 80%. Efficiency is said to be about 5% less than that of ac squirrel cage motors, but power factor is about the same. Packaged drives are longer than comparable dc motors and are smaller in dia. Drives are priced from $3000 to $500. Delivery, about 15 wk. **Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30.**

Circle 11, Reader Service Card

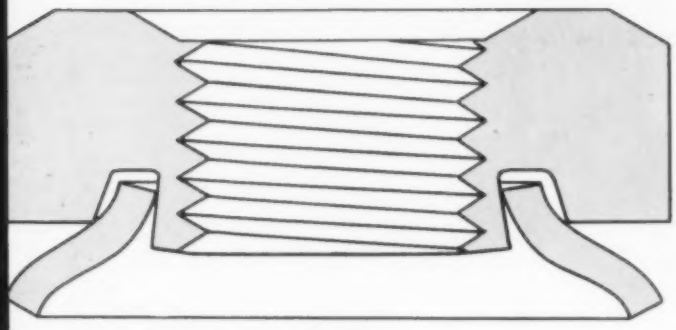


Fuel-level sensor . . .

replaces conventional floats and actuating mechanisms. Valves, closed when submerged in fuel, will reopen to relieve tank pressure exceeding a desired value. Permits free flow of air in both directions when exposed to air. It is not affected by altitudes and will perform in a 360° circle. Temperature range is −65 to 350 F. Said to work with all aircraft fuels. Valves eliminate problem of acceleration and mechanical failure due to vibration and slosh. Dimensions for a 1½-in. fuel line are 6.5x5 x3.75 in. wide. Weight is 2.2 lb. Can be adapted to any line size. Device is now in production. **Aero Supply Mfg. Co., Inc., Corry, Penna.**

Circle 12, Reader Service Card

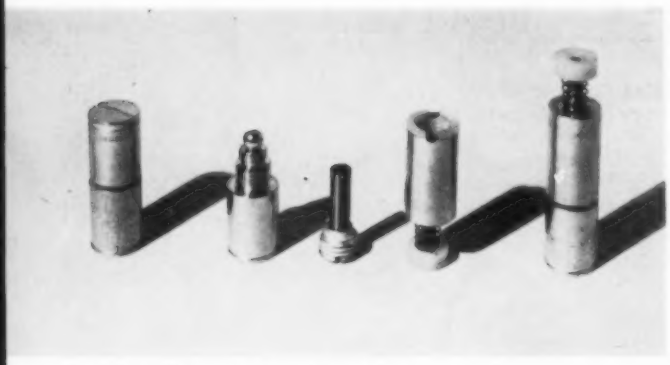
MATERIALS · EQUIPMENT



Hex nut and spring washer . . .

are preassembled in such a way that rotation of washer occurs when face of washer and back-up material meet. Tightening the nut causes modified cupped washer to deflect and maintain tension on bolt. Available in sizes 6-40, 8-32 and 10-32. All-metal assemblies are reusable. **Reliance Div., Eaton Mfg. Co., Charles Ave., Massillon, Ohio.**

Circle 13, Reader Service Card



Acceleration or deceleration . . .

will cause ball in this inertia switch to leave its inverted cone-shaped seat and contact cap, closing an electrical circuit. In momentary contact model, ball is pulled back onto seat as soon as acceleration falls below force level of adjustable Alnico magnet assembly, located below apex of seat. In magnetically held, reset model, cap is made of magnetic material and magnet maintains contact with ball until reset button is pushed. Standard models provide a range of acceleration levels from 0.15 to 20 G. Momentary contact types are $19.50 to $22.50 each; reset switches are $22.50 to $25.50 each in sample quantities. Delivery in about 3 wk. **Inertia Switch Div., Safe Lighting, Inc., 527 Lexington Ave., New York 17.**

Circle 14, Reader Service Card

Pilot lights with built-in resistors . . .

are designed for high-brightness neon plow lamps. Lamp requires less than 1 w on 250-v circuit. May also be used on dc circuits over 160 v. Resistance value for bright light on 105 to 125-v circuits is ¼ w. Other resistance values can be built-in for direct connection of the pilot light to commercial circuits up to 250 v. Mount in $\frac{11}{64}$ or $\frac{3}{8}$ in.-dia holes. **Dialight Corp., 60 Stewart Ave., Brooklyn 37, N. Y.**

Circle 15, Reader Service Card

Miniature gas turbine . . .

delivers 5 or 10 hp. As an auxiliary power unit, turbine is said to start under any conditions and can be supplied to furnish 400 cps ac or dc electrical power, pneumatic power, or combinations. Operates at temperatures from −65 to 165 F. A twin-spool, coaxial turbine, it is inaudible at 100 ft. Weighs 30 lb. Price and delivery information not available. **Propulsion Research Corp., sub. Curtiss-Wright Corp., Santa Monica, Calif.**

Circle 16, Reader Service Card

Proportioning heat control . . .

separates indicating and control functions, maintaining proper temperature control even if meter is not functioning. A resistance-type sensing element is said to be accurate within 2% of scale in ranges up to 1000 F. In operation, temperature of medium being heated is compared with set temperature by a measuring circuit. A difference signal is then sent to the control section, which apportions heat input necessary to maintain temperature. Modular, plastic-potted, electronic plug-in circuits are permanently sealed against dirt and moisture and are shock and vibration resistant. Indicating controller is $200, plus $25 for sensing element; 2-wk delivery. **Electronic Processes Corp. of Calif., 2190 Folsom St., San Francisco 10.**

Circle 17, Reader Service Card

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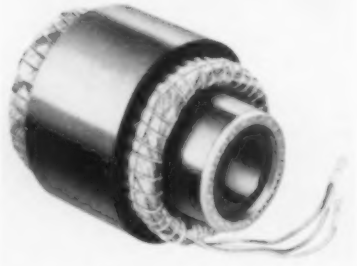
SIGNIFICANT PARTS MATERIALS EQUIPMENT . . .

Stainless steel solder . . . alloy is free of volatile elements such as cadmium and lead, is oxidation resistant. Alloy is finely powdered and contains silver, all suspended in a balanced liquid-flux composition. This preparation is applied to the surface to be bonded. Heat, preferably indirect, is applied until alloy flows. Bonding takes place at about 450 F. Can be used with stainless steel, steels, copper alloys, nickel alloys. Uses include sealing spotwelded and wrapped seams, step-soldering complex assemblies and filling holes, tool marks and scribed lines. Recommended for food contact applications. **Eutectic Welding Alloys Corp., 40-40 172nd St., Flushing 58, N. Y.**

Circle 18, Reader Service Card



Rotor and stator of motor . . . are available, without frame for mounting within product housing. Polyphase assemblies are offered in ¾ to 150-hp range; single-phase assemblies up to and including 5 hp. Drive shaft to be powered is locked into rotor and electrical controls and connections are planned jointly for electrical power source and the product. Motor costs that are as much as 40% lower than those of conventional drives are said to be possible. **Electric Motor Div., A. O. Smith Corp., Tipp City, Ohio.**

Circle 19, Reader Service Card

Potentiometer windings . . . are bonded to the card or mandrel, and insulating material removed where brush makes contact, without altering cross-section or leaving any residue of dirt particles. Method leaves windings clean of foreign matter and insulation without change in wire contour. Windings are ultrasonically cleaned and rinsed with special solutions before assembly into potentiometers. **DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y.**

Circle 20, Reader Service Card

News about HYPALON®

Seals of HYPALON in heat exchanger are undamaged by 125° F. aqua regia fumes

J. Bishop & Co. Platinum Works, refiners of precious metals at Malvern, Pa., have installed a new shell-and-tube heat exchanger to condense aqua regia fumes for safe disposal. The exchanger contains 1,275 Pyrex tubes each ⅜ in. diameter and 10 ft. long. Water circulates through the tubes; the aqua regia fumes are on the shell side.

Nearly 4,000 plugs of HYPALON, resembling one-hole bottle stoppers, are used to seal the tubes in the tube sheets—one seal per tube at the top tube sheet, two at the bottom. The seals of HYPALON permit thermal expansion and contraction; they prevent intermingling of fumes and water and they withstand aqua regia fumes at 125° F. The seals of HYPALON have been used for over 13 months without a failure.

HYPALON is especially suited for service where conditions are extreme. In addition to chemical resistance, this newest Du Pont synthetic rubber is completely resistant to ozone and highly resistant to heat, abrasion, weathering and flex cracking. Seals, gaskets, tank linings are but a few applications. Send coupon for details.

Seals of HYPALON resist corrosive action of hot aqua regia. 3,825 seals are used in this heat exchanger.

HYPALON *is a registered trademark of E. I. du Pont de Nemours & Co. (Inc.)*

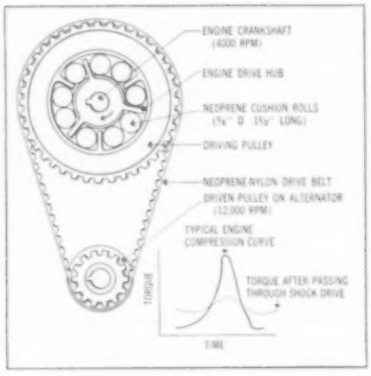
Neoprene shock absorbers replace flywheel in flyweight generator

Neoprene was chosen by Lear, Inc., of Santa Monica, Calif., in the design of a portable 1500 watt engine-generator set that weighs only 35 lbs. It consists of a 1200 rpm permanent-magnet generator driven by a toothed belt from a 400 rpm one-cylinder two-cycle engine.

There is no flywheel. It was eliminated to save weight. Instead, Lear engineers have interposed nine cylindrical neoprene cushions in the power train between the engine crankshaft and the drive pulley (see drawing). The cushions iron out torque surges inherent in a one-cylinder engine.

Engine pulsations rapidly wore out drive belts in an early experimental model built without flywheel or cushions. Now, models with neoprene shock absorbers get good service life from drive belts. (Belts are neoprene reinforced with nylon, toothed to maintain a strict 3-to-1 ratio between generator and engine.)

Use of neoprene cushions instead of heavy flywheel cuts weight of this portable 1500 watt generator to 35 lbs.



Neoprene was chosen for both the belt and cushions because it is the only rubber that resists both oil and ozone at once. In addition, neoprene's resistance to heat, abrasion, chemicals, grease and weather gives you an outstanding combination of properties for designs that call for a durable resilient material. Please mail coupon for more information.

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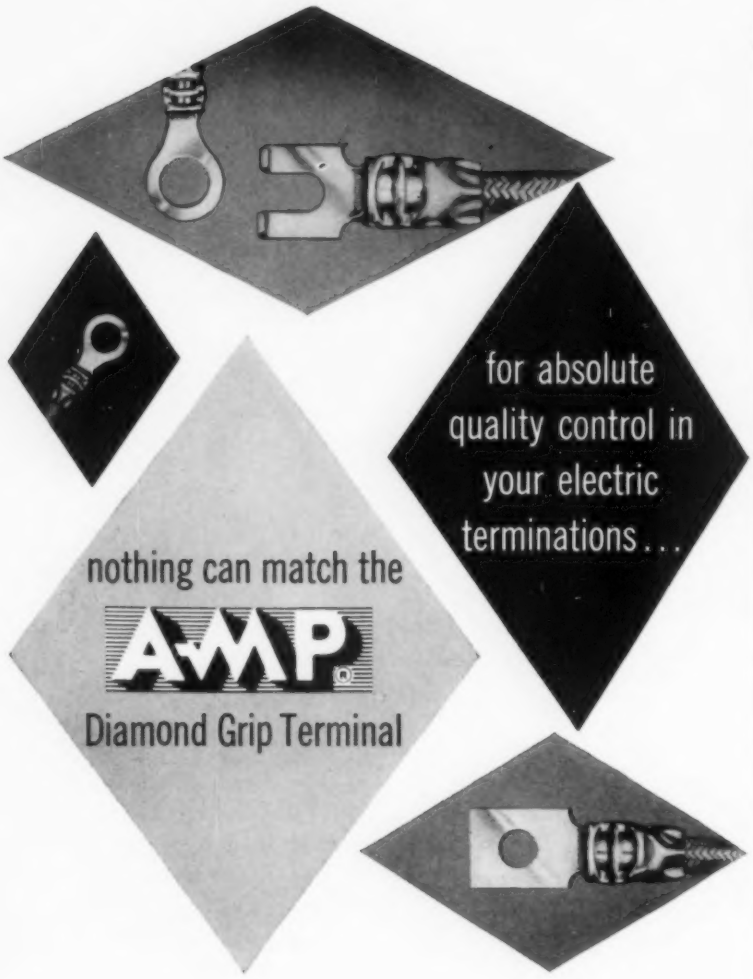

An endless parade of electrically perfect, wired terminals with absolutely identical performance characteristics is assured when A-MP non-insulated Diamond Grip terminals are used. No matter how many terminals you need, each action of the A-MP precision tool attaches a Diamond Grip terminal that gives firm, fully circumferential wire support, for maximum tensile strength, resists vibration and corrosion, while performing at maximum conductivity.

The reason for these never-varying features is the exact crimping operation which pressures the wire into one homogeneous mass and permanently bonds it to the terminal. Wire size range is from No. 26 to No. 10. Important, too, are the lower installed costs of Diamond Grip terminals when compared to other methods of wire termination.

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General Offices: Harrisburg, Pennsylvania

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SIGNIFICANT PARTS MATERIALS EQUIPMENT . . .

Silicon power rectifiers . . .

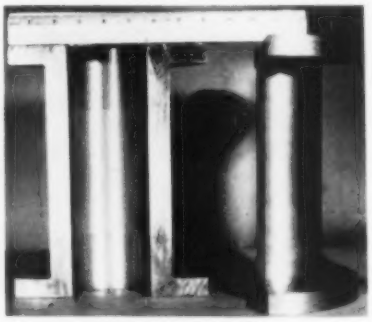
of diffused-junction type are rated for continuous service at 20 amp dc, at max peak reverse potentials up to 400 v. Four of the units in a full-wave bridge circuit provide power for a 10-hp, 230-v dc motor. Designed for dc power supply and magnetic amplifier applications requiring reliable performance to 302 F. Said to have low forward resistance and high reverse resistance. **Fansteel Metallurgical Corp., N. Chicago, Ill.**

Circle 21, Reader Service Card

Narrower wafer bearings . . .

have smaller widths in proportion to outside diameters than standard bearings. Through technique of through-boring, more iron and copper can be added to rotor and stators without increasing overall length of small motors, servos, synchros, potentiometers and gear trains in which they are used. Stainless steel bearings are offered in bore sizes from 0.0937 to 0.1875-in. dia.; housings from 0.2500 to 0.4357-in. dia. Load capacities are same as standard bearings. **New Hampshire Ball Bearings, Peterborough, N. H.**

Circle 22, Reader Service Card



Larger metal powder parts . . .

are now obtainable as the result of a silver solder bonding process. Any number of sections or parts can be permanently joined. A double-flange bearing was made by joining two flange sections to a sleeve bearing. Bearings 4½ in. ID x 9 in. long, and wearplates 12 x 12 x 2 in. have been produced. **Amplex Div., Chrysler Corp., P. O. Box 2718, Detroit 31.**

Circle 23, Reader Service Card

Tiny Tankers. Unicellular diatoms floated on prehistoric seas in infinite numbers, each encased a microscopic fat globule. Today, coalesced, they comprise the oil pools we draw upon. A wonder-of-the-world in miniature, truly a miracle of nature.

Magnetic Oil Finder. Modern triumph of miniaturization is the sensitive aerial magnetometer which trails an airplane for magnetic field surveys, locating new oil resources. 29 MPB bearings in it reduce friction for measuring accuracy 1 to 2 parts per 50 thousand.

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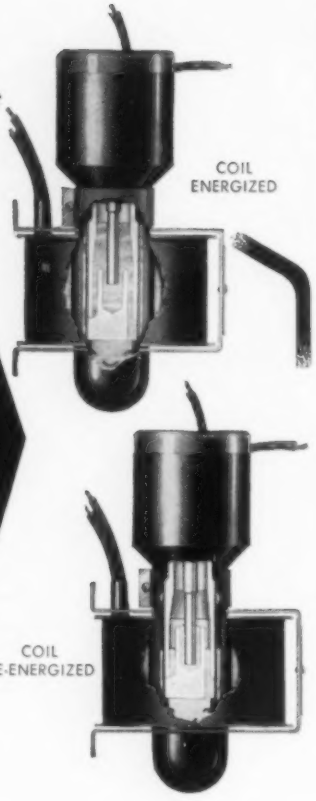

This steel clad, factory set, tamper proof Durakool timer-relay is practically non-breakable. Operating life multiplied 5 to 6 times by new plunger construction features. Combinations of operate-release time delays from 0.15 sec. to 20 sec.—either normally open or normally closed action.

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SIGNIFICANT PARTS MATERIALS EQUIPMENT . . .

Constant-speed power drive . . .

produces 16 in.-oz of torque at 1000 rpm. Tolerance on speed is about 0.1% with an input voltage variation of 20% and an input speed of 1100 rpm, ±15%. A typical unit measures 4¼ x 2 x 2 in. and weighs about 1 lb. This unit used a timing motor requiring 28 v dc at 3 w. Designed for computer and control system applications. **M. Ten Bosch, Inc., Pleasantville, N. Y.**

Circle 24, Reader Service Card

Silicone rubber compound . . .

has compression-deflection characteristics approximating those of firm sponge, yet is said to provide tensile, tear and elongation properties of a higher durometer silicone rubber. Compression set is about 30% or a 50% deflection after 70 hr at 300 F. Meets applicable military specifications and has —100 to 500 F flexible temperature range. Offered in custom sheets, moldings and extrusions. Suitable for extruded sealing strips, molded parts and cut gaskets for applications where highly resilient sealing or vibration dampening characteristics are desirable at extreme temperatures. **Connecticut Hard Rubber Co., 407 East St., New Haven 9, Conn.**

Circle 25, Reader Service Card

Memory storage unit . . .

is for moderate capacity where simple accessory circuits are desirable. Any one of 60 condensers, mounted on a rotating disk, are selectively charged for memory storage. Storage time is 3 minute max. Charging and pickoff may be continuous for proportional process control or drive shaft may be indexed to each condenser by a servomechanism. Max charging voltage is 200 v dc. It can be charged by a dc potentiometer and output can drive a meter indicator or a servosystem for process control. Unit is in cast aluminum housing. Driven by shaft mounted on ball bearings. **Industrial Control Co., 805 Albin Ave., Lindenhurst, N. Y.**

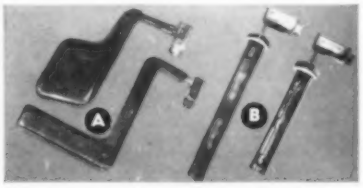
Circle 26, Reader Service Card

How to select cast-in immersion Heaters for Metal Melting Applications

Here is condensed information to help you get the most economical electric heater for any design problem where melting soft metals is a factor.

General Electric cast-in immersion heaters can be applied to virtually any process machine which uses soft metals in a molten state.

Two factors generally determine which General Electric cast-in immersion heaters should be used. They are: the physical characteristics of the machine or pot, and the temperature required.



"Over-the-side" immersion heaters (a), as their name implies, are merely suspended in the pot or crucible with their effective heating portions immersed directly in the metal. Installed in this manner, these heaters can be easily shifted to vary the heat distribution as required. Furthermore, these heaters can be added or replaced without shutting down the bath.

"Through-the-side" immersion heaters (b) are designed for relatively permanent mounting on the side of the crucible or pot by means of a gasketed flange header. This type of heater is best suited to smaller pots because of its relatively small radiating surface.

To figure the amount of heat required for your application:

1. Determine weight in pounds of the metal to be heated. (Volume of the pot in cubic feet x weight of metal in pounds per cubic foot from Table II.)
2. Determine operating temperature of metal bath from Table II.
3. Using the data obtained in Steps 1 and 2 above, read kilowatt hours from Table I.
4. Divide the answer obtained in Step 3 by the hours allowed for heat-up. You now know how many kilowatts of heat are required for your installation.

For complete information on sizes and ratings of General Electric heaters, call your General Electric Apparatus Sales Office or send coupon below.

DELIVERY TODAY: Popular sizes of General Electric heaters are available today from General Electric stocks near your plant.

SPECIAL SAMPLES: Your General Electric sales engineer can advise you on special heating problems. If special heaters are required, he will provide samples.

PROMPT SHIPMENT: General Electric's new Industrial Heating plant at Shelbyville, Indiana, is now geared to give excellent shipping dates on heaters for your production needs. Just call your nearest General Electric Apparatus Sales Office and tell us your requirements. General Electric Company, Schenectady 5, New York.

TABLE II METAL MELTING DATA

Metal	Wt in Lb per Cu Ft	Melting Temperature in Deg F	Heat Required to Melt 1 Lb		Watt-hours Required to Heat 1 Lb 1 F from Melting Temp.	Usual Operating Temp. in Deg F	Watt-hours Required to Bring 1 Lb to Working Temp.
			Btu	Watt-hours			
Lead	710	620	28	8.3	0.0098	725	9.2
Tin	455	450	47.5	14.0	.0187	600	16.7
Solder (1 part tin, 1 part lead)	555	400	33	9.6	.0152	650	13.8
Solder (2 parts tin, 1 part lead)	520	365	38.8	11.4	.0171	520	13

TABLE I TO DETERMINE KW HOURS

Weight in Lb	Solder (2 Parts Tin, 1 Part Lead)			Solder (1 Part Tin, 1 Part Lead)			Tin			Lead		
	470°F	520°F	570°F	600°F	650°F	700°F	550°F	600°F	650°F	700°F	725°F	750°F
	KW Hours			KW Hours			KW Hours			KW Hours		
100	2.3	2.4	2.5	2.3	2.4	2.5	2.7	2.8	2.9	2.5	2.6	2.7
500	9.3	10.0	10.7	9.6	10.1	10.7	11.5	12.0	12.5	4.7	5.2	5.7
1,000	18.3	19.3	20.3	18.6	19.7	20.8	22.5	23.5	24.5	18.1	19.1	20.1
1,500	25.5	27.0	28.5	33.7	35.2	36.7	32.0	33.5	35.0	23.9	25.4	26.9
2,000	38.0	40.2	42.5	46.5	48.5	50.5	47.0	49.0	51.0	33.0	35.0	37.0
2,500	46.0	48.0	50.2	54.0	57.0	59.5	56.0	58.5	71.0	44.3	46.8	49.3
3,000	52.0	56.0	60.3	61.3	64.6	67.8	66.0	70.0	74.0	50.0	53.0	56.0
3,500	60.0	64.0	68.5	68.7	72.4	77.0	75.0	79.0	83.0	56.0	59.5	63.5
4,000	67.0	71.5	76.5	76.5	80.7	85.0	84.0	89.5	94.5	62.0	66.5	70.5
4,500	75.0	81.0	87.5	83.5	89.0	95.0	94.0	100.0	105.0	68.0	73.0	78.0

GENERAL ELECTRIC

Section A723-27, General Electric Co.
Schenectady 5, New York

Please send GEA-5098, melting metals, and GEA-6113, Selector Guide for Metal Melting, and GEC-1005, catalog of G-E Heaters and Devices.

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NEW LITERATURE

Oral Communication of Technical Information

ROBERT S. CASEY, *Chief Chemist, W. A. Scheaffer Pen Co., Reinhold Publishing Corp., 430 Park Ave., New York 22. 5x7¼ in., 199 pp. $4.50.*

Again and again, we see the failure of one engineer to convey his idea to others or to the executive or lay mind. This little book is a help in that direction. It explains barriers and bridges to communication, how to do it, organization, oral delivery (both formal and informal), visual and audio aids, presiding at meetings, talking to laymen, giving technical legal testimony. It even gives a bit of advice on social conversation.

For the man who trips over his technical tongue (and who doesn't?) this is real help in compact form. It will not teach you how to tell jokes in a speech or how to spot them to avoid that deadly initial sentence, "Ladies and gentlemen: I am reminded of the story of . . ." and you'll strain aging eyes to read the blue type under some lighting, but you'll have a guide—with reference to further articles on the subject. —EJT

Soviet Electronics Literature

"Electronics Express" is the first of a group of three periodicals to appear devoted to the research efforts of a group of Soviet researchers and engineers. Like its companion publications, **"Automation Express"** (due this month) and **"Physics Express"** (soon, but no date announced as yet), the new magazine is to be issued 10 times a year. Each issue is expected to contain several complete papers, extensively excerpted material, together with abstracts and bibliographical data. Price for a subscription to one of these periodicals is $7.50 per year. *By International Physical Index, Inc., 1909 Park Ave., New York 35.*

Industry and Technical Progress in Britain

C. F. CARTER *and* B. R. WILLIAMS. *Published by Oxford University Press, 114 Fifth Ave., New York 11. 5¾x8¼, 244 pp. $4.*

This book is a report, by the two directors of research of the Science and Industry Committee, Royal Society of Arts in England, on the need for the rapid application of science and technology in British industry. After surveying the economic background, the authors examine a number of specific subjects. Their investigations have led the authors to cast doubts on a number of accepted points of economic theory.

First, the problems of basic research are discussed, as well as problems of communicating research results to industry. Then, certain key factors in the application of science and technology, such as the supply of trained personnel, the supply of money, the effects of taxation, the stimulation received from other firms, and certain implications for agriculture.

VARIABLE TRANSFORMER—Bulletin P258G, 100 pp. Contains engineering data, outline drawings, connections, ratings, charts on all standard 50/60-cps units plus some special types. Superior Electric Co., Dept. P258G, Bristol, Conn.

Circle 1, Reader Service Card

ENCLOSED WORM GEAR DRIVES—Engineering Manual HGB, 80 pp. General specifications, descriptions, selection procedure, ratings, dimensions and assemblies for reducers. Also specification data on couplings. Illustrated with dimensional drawings and photos. Foote Bros. Gear & Machine Corp., 4545 S. Western Blvd., Chicago 9.

Circle 2, Reader Service Card

SEAMLESS STEEL TUBING — Handbook, 56 pp. General data on cold-drawn seamless steel tubing, its manufacture and trade practices and purchasing; specific descriptions, tolerances and other specifications on mechanical, pressure and aircraft tubing. Supplemented with formulas and reference tables. Michigan Seamless Tube Co., South Lyon, Mich.

Circle 3, Reader Service Card

DATA CONTROL—Brochure, 20 pp. Describes facilities, personnel, past projects of organization specializing in development of data processing equipment and systems. Epsco, Inc., 588 Commonwealth Ave., Boston 15.

Circle 4, Reader Service Card

RESEARCH & DEVELOPMENT—Brochure, 4 pp. Describes background of company facilities. Electronic Engineering Co. of California, 1601 E. Chestnut, Santa Ana, Calif.

Circle 5, Reader Service Card

INDEX TO ADVERTISERS

This index is published as a convenience to the readers. Every care is taken to make it accurate but PRODUCT ENGINEERING assumes no responsibility for errors or omissions.

AMP, Inc. 42
Allied Research Products, Inc. 31
American Brass Co. 4
American Cast Iron Pipe Co. 20

Behlen Mfg. Co. 13
Bound Brook Oil-less Bearing Co. ..... 2nd Cover

Chicago Molded Products Corp. 44
Cone-Drive Gears Div., Michigan Tool Co. 14

Dow Chemical Co. 15
du Pont de Nemours & Co., (Inc.), E. I., Elastomers Dept. 41
du Pont de Nemours & Co., (Inc.), E. I., Film Dept. 3
du Pont de Nemours & Co., (Inc.), E. I., Photo Products Dept. 29
Durakool, Inc. 44

Fluidwick Co. 48

Gast Mfg. Corp. 28
General Electric Co., Apparatus Dept. 45
Grant Pulley & Hardware Corp. 16

Heim Co. 48
Hommel Co., O. 44

Kraissl Co., Inc. 24

Link-Belt Co. 6

Michigan Tool Co., Cone-Drive Gears Div. 14
Miniature Precision Bearings, Inc. 43
Molded Fiber Glass Co. 25
Mueller Brass Co. 36-37

Parker-Hartford Corp. 40

Saginaw Steering Gear Div., General Motors Corp. 11
Sharon Steel Corp. 9

Technic, Inc. 26
Torrington Co., Specialties Div. 30

U. S. Electrical Motors, Inc. ..... 3rd Cover
U. S. Graphite Co., Div. of the Wickes Corp. ..... 4th Cover
U. S. Rubber Co., Naugatuck Chemical Div. 27

Warner Electric Brake & Clutch Co. 47

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WARNER
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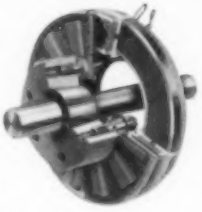
for IDEA MEN

Electric brakes synchronize automatic paper pasting!



Modern, high-speed news presses don't stop when they come to the end of a paper roll. The paster pilot, located beneath the press, automatically splices on the start of a new roll and cuts off the remnant of the old one while the press is operating at speeds up to 60,000 papers per hour.

Warner electric brakes prevent rocking, automatically release when splice is made

Electric brakes are mounted on each roll spindle (Fig. 1) and prevent the rolls from rocking motion sometimes caused by imperfect balance of the newsprint. With positive braking and automatic release, it is no longer necessary to manually brake the rolls or stop the press while a splice is being made.

When the new roll is indexed into pasting position, the brush and web-severing carriage is lowered, the pre-drive takes over, and the pasting is completed "on the fly." The paster pilot conserves newsprint by "sensing" press speed and automatically presetting the time for the pasting cycle, thereby producing uniform cores with 3/16 in. or less of paper.

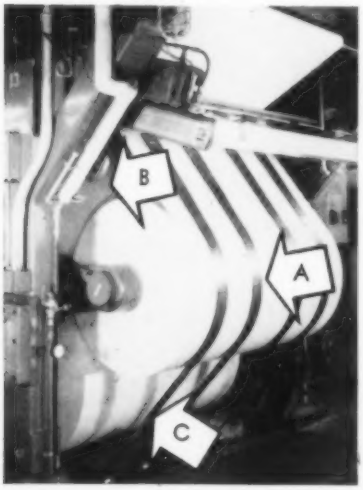


Fig. 1—Continuous printing is made possible by automatic paper splicing. Brush and web-severing carriage, directly above expiring roll (A), paste on the new roll (B), which then becomes the expiring roll. Loading roll (C) indexes into new roll position.

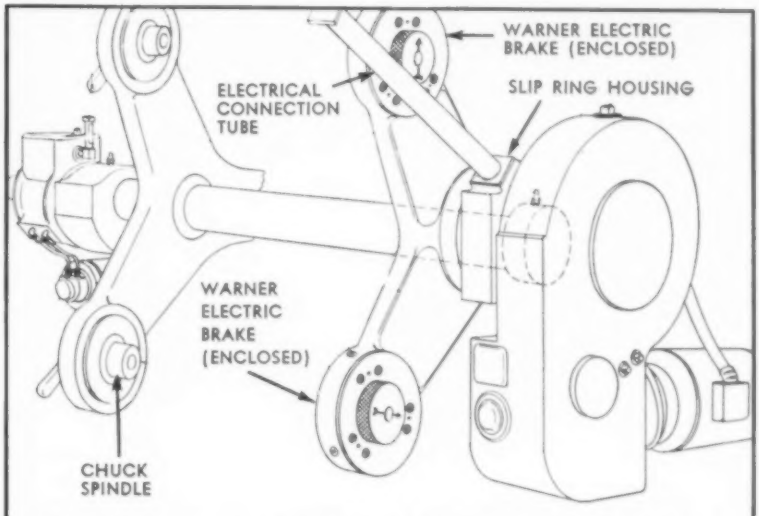
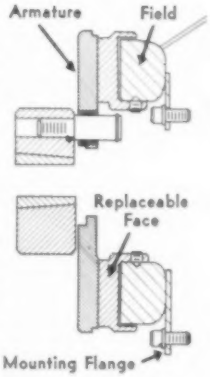


Fig. 2—Warner electric brakes are mounted on each roll spindle to prevent rocking and provide synchronized release at high speeds when splice has been completed.

Spacesaving design solves mounting problem

One of the design problems on this equipment was to fit the electric brakes into the compact, enclosed spindle indexing assemblies. Warner's compact armature-magnet design easily solved this problem. The electrical connections were made through the reel spider from a slip ring on the main reel spindle. Wiring was strung in from a stationary connecting tube (see Fig. 2) to the brushholder assembly.



New replaceable-face electric brakes

Many users of Warner electric brakes are switching over to our new replaceable-face design. In most cases, this change can be made without redesign of the product. Benefits to the customer include longer wear life and easier replacement of friction surfaces without disturbing electrical connections.

The "RF" brake (see sketch) consists of three basic elements, one rotating and two stationary. The field and replaceable face are assembled as one unit, which is flange-mounted to the machine. Properly installed, the field and its electrical connections never have to be disassembled or adjusted. The replaceable-face assembly fits *over* and *around* the field, and is affixed thereto by a number of easily accessible cone-pointed setscrews. The rotating member, or armature, is hub-mounted to the shaft and driven by pins which provide automatic wear adjustment. No other electric brake, no matter how similar to the Warner design, gives you the service and wear life features of the "RF" design.

Want more IDEAS?

Send for factual application sheets showing how machines are made more productive, easier to control, simpler to maintain with electric brakes and clutches. Write to:

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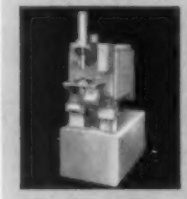

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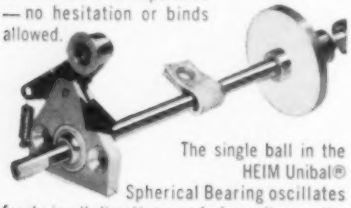

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Publisher's Postscript...

Your eyes and ears ON THE MOVE

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This is the business card our editor is currently using. Translated, it says: *E. Dg. Tandgerman, Editor of Journal, Product Engineering, Publishing House McGraw-Hill Publishing Company, 330 West 42nd Street, New York 36, New York, U. S. A.*

Mr. Tangerman flew to London on April 24. He'll spend several weeks in Russia to learn everything he can about Russian engineering and product design. He will also confer with engineers in all of the important industrial cities throughout Europe: Paris, Bonn, Milan, Geneva, Zurich, Stockholm, London and others. He'll spend some days at the Brussels and Hanover fairs as well.

In coming issues Editor Tangerman will be bringing you his observations. He'll report to you on what he learns in Russia and you can be sure, too, that he will lay the groundwork for more complete reporting of the kind of information you want by the resident editors and reporters of McGraw-Hill news bureaus throughout Europe.

So, in these weekly pages, you will be getting a continuously broader picture of what's going on overseas. This in addition to the intensive reporting of product-design activity throughout the Americas. —AH

For Your Information (personal)

Build 'em with plastic bones

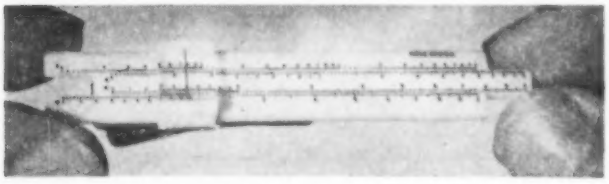
If your kids have an engineering turn of mind, and are interested in natural sciences too, Ideal Toy Corp. and Plastics Masters, Inc. have just the thing for them: model-making kits, with bones precision-molded in styrene plastic.

From Ideal comes a series of dinosaur models, first of which is the 48-piece Tyrannosaurus Rex put together by the lad here (Price: $1.98). The Stegosaurus will be along shortly, with others to follow.

Human skeletons, about a foot high, molded of Marlex linear polyethylene, are also being made available nationally, in both kit and assembled form. These, from Plastics Masters, Inc. Here, the choice of material is particularly interesting. Regular polyethylene would be too soft; polystyrene too rigid for snap-in joints; nylon too expensive. High-density polyethylene is excellent. Price of the kit is about $2; of the assembled skeleton, with transparent plastic cover and stand, about $5.

Not as new, but of special interest to engineers is a model-building kit for machine designers. It includes rods, beams, bearings, ratchets, pulleys, springs, and joints, can be used to build almost anything from a testing machine to a printing press (*PE—Nov. 4, '57, p. 43*).

Another slide-clasp ready for work



All plastic and fully operable, this 2½-in. slide rule-tie bar not only calculates, but also serves as a tie clasp. Priced at $2.75, it is made by Baby Slide Rule Co., P. O. Box 9, East Lansing, Mich. (For news of other clip-on rules, operable and inoperable, see *PE, FYI section*, Oct. 21, '57, and Dec. 16, '57.)

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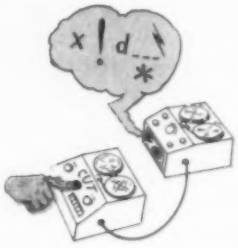
WHY DON'T THEY RESEARCH and DEVELOP...

. . . a small, battery-operated automobile? It should have a 50-mile range per charge, 30-mph top speed, be rechargeable off house current and be priced from $200 to $500. It would serve admirably for shopping and for husband and child pick-up and delivery. Result: a lot less air pollution, traffic deaths, and less wear and tear on the family pocketbook. —R. L. WOLFE

. . . a small ultrasonic generator to be permanently installed in homes. It would operate during summer months to repel, stun or paralyze insects and termites. Honeybees and ship's barnacles are controlled in this way quite successfully. Cost of screens would be eliminated, and houses would last a good deal longer.
—H. HARTMANN
E. A. KREMEYER



. . . a self-editing conference recorder. Continuous recording takes much time during playback. Summary or highlight recording interrupts the flow of a conference and is not feasible during lectures. Intermittent recording requires rare foresight to capture important statements. A magnetic tape loop which is continuously recording and erasing and has a pickup head connected to a second tape recorder would permit automatic editing. A touch of a button after each important point would transfer the stored words from the loop to the auxiliary recorder. A battery-operated transistorized unit is feasible. —L. DAUM

. . . a good ball-point drafting kit. It would include three sizes of inserts for different line widths which could be snapped into pencil holders and compasses. A liquid eradicator might be stored in the end of the pencil and released through a sponge-type swab. Result: smear-proof drawings, better blueprints, faster erasures, uniform line width. —J. A. BURDEN

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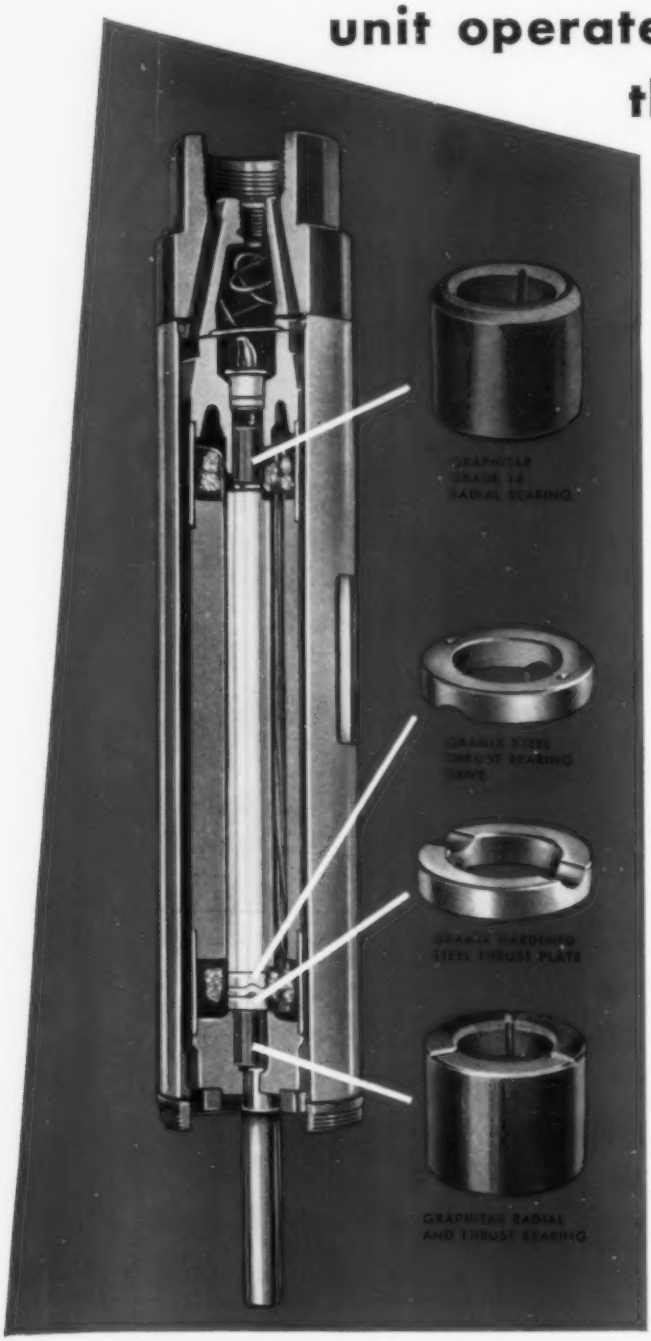
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